For Reference

NOT TO BE TAKEN FROM THIS ROOM

For Reference

NOT TO BE TAKEN FROM THIS ROOM

Ex libris
Universitatis
Albertaensis

QUAECUMQUE VERA

The University of Alberta
Printing Department
Edmonton, Alberta

BRUCE PEEL SPECIAL COLLECTIONS LIBRARY
UNIVERSITY OF ALBERTA LIBRARY

REQUEST FOR DUPLICATION

I wish a photocopy of the thesis by

____(author)

entitled____

The copy is for the sole purpose of private scholarly or scientific study and research. I will not reproduce, sell or distribute the copy I request, and I will not copy any substantial part of it in my own work without permission of the copyright owner. I understand that the Library performs the service of copying at my request, and I assume all copyright responsibility for the item requested.

____

Digitized by the Internet Archive
in 2022 with funding from
University of Alberta Libraries

https://archive.org/details/Tracie1970

THE UNIVERSITY OF ALBERTA

AN ANALYSIS OF THREE VARIABLES AFFECTING FARM LOCATION IN THE PROCESS OF AGRICULTURAL SETTLEMENT: THE SOUTH PEACE RIVER AREA

by

© CARL JOSEPH TRACIE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF GEOGRAPHY

EDMONTON, ALBERTA

SPRING, 1970

Thesis
1970
59D

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled AN ANALYSIS OF THREE VARIABLES AFFECTING FARM LOCATION IN THE PROCESS OF AGRICULTURAL SETTLEMENT: THE SOUTH PEACE RIVER AREA submitted by Carl Joseph Tracie in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

ABSTRACT

One of the basic concerns of settlement geography is understanding the process by which an area is occupied. This study attempts to fulfill two aims: to provide a meaningful description and analysis of the process of agricultural settlement in the South Peace River area of Alberta, and to contribute to an understanding of the broader processes of agricultural settlement by the quantitative analysis of certain locational variables through time.

Three variables were chosen as basic locational determinants in the choice of agricultural land: the vegetative cover, the distance to the nearest major transportation route, and the distance to the nearest settlement. The vegetative cover at the time of settlement was reconstructed and the transportation and settlement networks for various time periods were plotted. All land entered and all available land for each of the 17 time periods was classified according to each of the three variables. The association between the process of agricultural settlement (as indicated by the initial entry date on each unit of land) and each variable was tested by various applications of the chi-square test. A final step was testing the association between the process of agricultural settlement and various combinations of the variables to provide more detail on their interaction and relative importance through time.

Briefly, the major findings of the study were:

1) The vegetative cover appeared to be the most probable determinant of farm location in the period 1908-1927.

2) Considerations of distances to settlements and major transportation routes appeared to be more significant than vegetation in determining farm location in the period 1928-1968.

3) Vegetative cover and the distance to a settlement were perceived consistently as factors in farm location throughout the total time period (1908-1968).

4) Generally, farmers tended to choose land with 20 per cent or more grassland and avoided land with less than 20 per cent grassland in terms of vegetation. In terms of the distance variables the critical zone between choice and avoidance seems to have been between 5 and 8 miles from settlements and major transportation routes.

ACKNOWLEDGMENTS

It is a pleasure to acknowledge the assistance of several people in the preparation of this thesis. I would like to thank Dr. W.C. Wonders in particular for efficiency and encouragement in the supervision of the thesis and throughout my graduate work. Dr. V.B. Proudfoot gave liberally of his time in the discussion of many aspects of the thesis and Dr. O.F.G. Sitwell was particularly helpful in his suggestions and comments on the use of the chi-square test. Dr. G.H. LaRoi, Department of Botany, U. of A., and Dr. H. Vaartnou, Alberta Department of Agriculture made valuable suggestions regarding the vegetation classification.

I would like to acknowledge the assistance of W.H. Bogdan, cartographer and H.P. Holwein, technician, Department of Highways, in making available the surveyors' notebooks. I was given much cooperation by H.E. Bennett, Registrar, and Mrs. M. Jacobs of the Department of Lands and Forests, in the collection of data from the Township and Homestead records.

I would like to thank J. Chesterman, technician, for his excellent reproduction of the maps. Miss D. Rose did all the programming for the thesis and her conscientious attention to detail has greatly facilitated analysis of the data.

In addition, I am grateful to the Canada Council for Doctoral Fellowships in 1968-69 and 1969-70 which allowed me to devote my time almost wholly to thesis research. Finally, I would like to express my appreciation to my wife, Darlene, for her careful typing of the final draft and for her support and encouragement which made the completion of this thesis possible.

TABLE OF CONTENTS

ABSTRACT

ACKNOWLEDGMENTS

TABLE OF CONTENTS vi

LIST OF TABLES viii

LIST OF FIGURES x

CHAPTER I THE PROBLEM 1

CHAPTER II THE STUDY AREA 9

- A. Location and Choice of the Area 9
- B. Physical Characteristics 13
- C. General Agricultural Settlement 17

CHAPTER III LAND ENTRY AND VEGETATIVE COVER 22

- A. Material 22
- B. Analysis 30
  - 1. General Associations 32
  - 2. Specific Associations 37

CHAPTER IV LAND ENTRY AND DISTANCE TO A MAJOR TRANSPORTATION ROUTE 45

- A. Material 45
- B. Analysis 50

CHAPTER V LAND ENTRY AND DISTANCE TO NEAREST SETTLEMENT 68

- A. Material 68
- B. Analysis 69

CHAPTER VI LAND ENTRY AND COMBINED VARIABLES 84

A. General Comparative Analysis 86

B. Specific Comparative Analysis 89

CHAPTER VII THE PROCESS OF AGRICULTURAL SETTLEMENT IN THE SOUTH PEACE REGION 106

CHAPTER VIII CONCLUSIONS 117

BIBLIOGRAPHY 121

APPENDICES

APPENDIX A The Chi-Square Test 127

APPENDIX B Climatic Summaries 131

APPENDIX C The Process of Land Entry and Land Alienation (Figures 5 - 15) 134

APPENDIX D Category Values - Land Entry and Combined Variables 146

APPENDIX E Information Recorded on IBM Punch Cards 153

APPENDIX F Transportation Routes: Map Sources . . . 155

LIST OF TABLES

Table	Title	Page
3.1	Entries in Each Time Period According to Vegetation Category	26
3.2	Lands Made Available by Survey	30
3.3	Land Available in Each Time Period According to Vegetation Category	31
3.4	Expected Frequency of Entries According to Vegetation Category	34
3.5	Category and Chi-Square Values - Vegetation and Land Entry	35
3.6	Chi-Square Values of Paired Vegetation Category	41
4.1	Land Available According to Distance From Nearest Major Transportation Route	48
4.2	Entries According to Distance Category	49
4.3	Category and Chi-Square Values - Land Entry and Distance to Nearest Major Transportation Route	54
4.4	Chi-Square Values for Paired Distance Categories - Land Entry and Distance to Nearest Major Transportation Route	59
4.5	Chi-Square Values for Consolidated Distance Pairs - Land Entry and Distance to Nearest Major Transportation Route	62
5.1	Land Available According to Distance From Settlement	70
5.2	Land Entered Upon According to Distance From Settlement	71
5.3	Category and Chi-Square Values - Land Entry and Distance to Settlement	75

5.4 Chi-Square Values for Pairs of Distance Categories - Land Entry and Distance to Settlement 79

5.5 Chi-Square Values for Pairs of Consolidated Distance Categories - Land Entry and Distance to Settlement 81

6.1 Category Values for 1915 - Land Entry and Vegetation/Distance to Transportation 92

6.2 Category Values for 1928 - Land Entry and Vegetation/Distance to Transportation 93

6.3 Category Values for 1915 - Land Entry and Vegetation/Distance to Settlement 96

6.4 Category Values for 1928 - Land Entry and Vegetation/Distance to Settlement 97

6.5 Category Values for 1911 - Distance to Transportation/Distance to Settlement 99

6.6 Category Values for 1916 - Distance to Transportation/Distance to Settlement 101

6.7 Category Values for 1928 - Distance to Transportation/Distance to Settlement 103

LIST OF FIGURES

Figures	Title	Page
1	Alberta - Location of the Study Area	10
2	Location and Physical Features	11
3	Vegetation About 1910	27
4	Major Transportation Routes and Post Offices	67
5	Land Entry 1911	135
6	Land Entry 1912	136
7	Land Entry 1914	137
8	Land Entry 1916	138
9	Land Entry 1918	139
10	Land Entry 1928	140
11	Land Entry 1957-68	141
12	Land Patented 1916	142
13	Land Patented 1928	143
14	Land Patented 1938	144
15	Land Patented 1968	145
Transparency	Location and Physical Features (in back pocket)	

CHAPTER I

THE PROBLEM

The geography of settlement may be said to have two major research themes, one concerned primarily with settlement as form, the other with settlement as process. Although intrinsically related the difference in emphases between the two allows the classification of most studies in settlement geography as either form or process studies. It would seem that studies concerned with settlement process could be subdivided further into those concerned with the process of settlement expansion or settling (occupation of previously unoccupied areas) and those concerned with the process of settlement change (morphological, functional and spatial changes in settlement forms in an occupied area). As process studies, both must be evaluated in a historical or chronological context. In this theoretical framework, the present study would be classed as one concerned with settlement or settling as a process in settlement expansion.

In this context, one of the most complex and fundamental tasks is the evaluation of the influence of certain locational factors in determining priorities in the selection of initial settlement location. This evaluation is essential to an understanding of current settlement patterns and to predictions as to the possible arrangement of settlement units in presently unoccupied areas. The relative significance of these factors must be considered not only at a specific time, but also as they vary through time. Such variations may have many causes: technological advances, national and international political and economic pressures, cultural and social changes. Broadly speaking the

factors influencing choice of settlement location can be grouped into three categories: physical, socio-cultural and economic. In treating agricultural settlement, then, the problem becomes one of identifying farmers' priorities in choice of land in terms of these three groups of determinants and of evaluating their relative importance through time.

Often regional studies in settlement or historical geography deal with the problem of locational determinants only in the period of initial settlement and in subsequent periods go on to consider the changing morphology, distribution and function of the farms and farmsteads. Even studies that are primarily concerned with establishing the significance of certain locational determinants often leave unanswered questions concerning the inter-relationships between different types of determinants and the change in significance of these inter-relationships through time. For example: how did distance from major transportation routes affect the ring-like settlement process that Barrows found operative in the Big Prairie of Illinois?[1] Hewes[2] pointed out that in Story County, Iowa, the railway did not exercise an all-important role in directing agricultural settlement location. He found that the major factor was the proportion of prairie and forest on the land unit and that most of the county was closely settled while the nearest railroad was five or even ten miles distant.

---

[1] Barrows, H.H., "Geography of the Middle Illinois Valley", Illinois State Geol. Survey, Bull. 15, 1910, pp. 77-80.

[2] Hewes, L., "Some Features of Early Woodland and Prairie in a Central Town County", AAAG, Vol. 40 (1950), pp. 40-57.

Even in this context the question arises as to the influence of the railroad on relative choice of land five to ten miles away. Was the land four or five miles away chosen before that which was nine or ten miles distant? Or given the operation of both vegetation and distance variables, was the preference for well-drained prairie so strong as to guarantee the priority of choice of well-drained prairie six or seven miles from the railroad over poorly-drained or lowland prairie two or three miles from the railroad? Jordan[3] found that preference for land with a mixed forest-prairie cover remained steady through time and among several different cultural groups. It would be interesting and useful to know in which direction preference leaned after the mixed forest-prairie land was occupied - toward forest land or toward prairie land, and again, what effect if any did distance from major transportation routes or from larger settlements have upon these choices.

This is not to diminish the valuable contributions of these studies to the understanding of the settlement process but rather to point up the need for an intensive, quantitative study of the variation in dominance and inter-action of important locational determinants through time. This study then is an attempt to establish the importance and interaction of certain locational determinants in the process of the expansion of agricultural settlement in a selected area. In so doing the author hopes to fulfill two aims - to provide a meaningful description and interpretation of the process of agricultural settlement in the South Peace River area of Alberta and to contribute to the

---

[3] Jordan, T.G., "Between the Forest and the Prairie", Agricultural History, Vol. 38, (1964), pp. 205-216.

understanding of the general process of agricultural settlement by a detailed and representative case study.

Clearly it would be impossible to evaluate the whole range of locational determinants both for reasons of time and for the fact that some could be given only by the original settler himself. What must be done rather is to look at the farmers' priority of choice of land and evaluate the physical, economic and social characteristics inherent in the land and its location at the time the initial selection was made. By relating these characteristics to priority of choice as indicated by the date of initial occupance, certain recurring associations may be identified. The problem then is to select certain basic locational factors from the complex array that influenced the farmers' choice. To facilitate comparison of the types of factors involved an attempt has been made to choose one factor representative or basic to each of the three general categories mentioned above.

Several physical determinants of specific farm choice immediately come to mind: soil, slope, drainage and vegetative cover. Vegetative cover was chosen as a basic physical determinant for several reasons. It serves as an indicator of other physical variables, most especially of soil and drainage, and was so utilized by the earlier settlers. In referring to the problem of settlement adjustment in marginal areas, Paget commented, "Settlers . . . are attracted to those areas which they are capable of managing or controlling." and went on to say that this concept was especially important "where the control of water (power) supply, or the regulation of drainage or the clearance of

vegetation is involved."[4] By the time of initial settlement of the study area, experience had exploded the myth of the infertility of the prairie (if indeed it was this concept that delayed prairie settlement),[5] and yet insofar as the concept of manageability is concerned, the distinction between prairie and forest was still very important. The promotional literature of the day weighted the influence of this variable as well, with its emphasis on the advantage of the "prairies" of the study area. Finally, in terms of the type of original vegetative cover (ranging from open grassland to forest) the area is representative of a large "parkland" area that formed the buffer between original prairie and forest in many sections of North America, most especially that of Western Canada.

The choice of determinants basic to the other categories was more difficult. It was felt however that distance to the nearest major transportation route and distance to the nearest settlement were indicative of the concern for certain economic and social advantages. While it seems clear that the first is more an economic factor and the second more a social factor, there are economic and social implications in each. Transportation routes are important not only in the economic sense of moving products, but serve social ends as well by facilitating inter-farm and inter-settlement contact. The criterion of distance to settlement indicates a concern not only for social activities but in the

---

[4] Paget, E., "Comments on the Adjustment of Settlement in Marginal Areas", Geog. Annaler, Vol. 42 (1960), p. 325.

[5] Jordan, op. cit.; Brown, R.H., Historical Geography of the United States, Harcourt, Brace and World Inc., N.Y., 1948, p. 208.

case of larger centres, a concern for markets and services. Transportation networks and the distribution of settlement centres have been, and are, commonly used to describe and explain settlement patterns and development so it seems reasonable to expect the spatial relationship of individual farms to them to be key determinants in locational choice. In reality the social factors involved are probably most poorly represented by these indicators. They are so complex and in some cases so subtle as to render such a deductive approach ineffectual.

The effects of the cultural background of settlers in influencing perception of certain physical and locational variables is not treated in this study. Other studies have been concerned with this as a determinant of location[6] but the data are too inexact and the scale of this study too detailed to permit consideration of this variable.

The three variables chosen for consideration then are: a) vegetative cover; b) distance to the nearest major transportation route and c) distance to the nearest settlement. All variables are evaluated at the time of settlement. The purpose of this study is to establish the significance of the association between the settlers' choice of farm location and these three variables at particular time periods and to identify changes in significance throughout the time span of agricultural settlement. As indicated above, characteristics of the land itself are utilized to identify the influence of these variables. All

---

[6] Jordan, op. cit., p. 205-216; Lehmann, H., "Zur Karte Deutschtums in den Kanadischen Prairieprovinzen", Deutches Archiv fur Landes- und Volkforschung, Vol. 3 , 1938, pp. 859-866; Van Cleef, E., "The Problem of Scientific Settlement as Illustrated by the Finns", Proceedings Int. Geogr. Cong., Paris, 1931, pp. 281-287.

the land units (160 acres or quarter-section) are classified according to each variable. The frequency with which certain kinds of land (as determined by the variable utilized) were being chosen is determined by noting the characteristics of the land entered upon in each time period. This gives an indication of the farmers' priority of choice with regard to each variable.[7] By relating the amount of each kind of land being entered (number of quarter-sections) to the amount of each kind of land available to the settler, the significance of the association between land choice and a specific variable is obtained.

The computation of this significance of association is done by means of the chi-square test. In very general terms this test evaluates the difference between the distribution of observed frequencies (the number of quarter-sections actually entered in each category) and the expected frequencies (the number of quarter-sections one would expect to be entered in each category if the selection was governed by chance i.e. in proportion to the amount of land available in each category) and expresses this difference as a chi-square value. The probability of the observed distribution (as classified according to a certain variable) occurring as the result of chance can be ascertained by relating this value to a table of the probability distribution of chi-square values. A more detailed explanation of the chi-square test is found in Appendix A.

---

[7] Only the first entry on a unit of land is considered to be indicative of priority of choice. This study is not primarily concerned with the success or failure of that first entry nor with subsequent entries on land previously abandoned.

By classifying all the land entered and all the land available in each time period according to each of the three variables, and by applying the chi-square test to each of the resultant distributions, one may arrive at a measure of the significance of association between farm choice and each variable. The analyses of the patterns of chi-square values through time plus consideration of the abnormal preference and avoidance of certain categories of land within each time period lead to valuable insights into the relationships between priorities in location choice and the three variables in each time period and through time. These insights in turn allow for a more meaningful analysis and description of the process of agricultural settlement in the study area, particularly in terms of the three variables under consideration.

CHAPTER II

THE STUDY AREA

A. Location and Choice of the Area

The Peace River region of northwestern Alberta was chosen as the general area for testing the variables of physical conditions and distance on the process of agricultural settlement. This region can be defined in various ways but in the context of this study is best understood as the occupied area adjacent to the Peace River and its major tributaries in northwestern Alberta between 55° and 59° N latitude. The study area is the southwestern corner of the larger region and is bounded on the south by the Wapiti River, on the east by the Smoky River, and on the west by the Alberta-British Columbia boundary and on the north by the north boundary of Township 75 in Ranges 2 through 13, West of the 6th Meridian (see Figures 1 and 2). Thus defined it encompasses approximately 2440 square miles and includes 9746 quarter-sections (160 acres), the basic land unit of the study.

The study area has several characteristics that render it particularly suitable for analyzing the process of agricultural settlement. Agricultural settlement of the area has been relatively recent. The whole range of settlement from initial occupance to the present can be treated in a time span of only 60 years (1908-1968). This facilitates both collection and interpretation of data. Almost 20 per cent of the area is presently available for settlement which allows consideration of the characteristics of current agricultural expansion.

Physical barriers to agricultural expansion contain the area on all sides: the deeply-incised Smoky and Wapiti Rivers on the east and

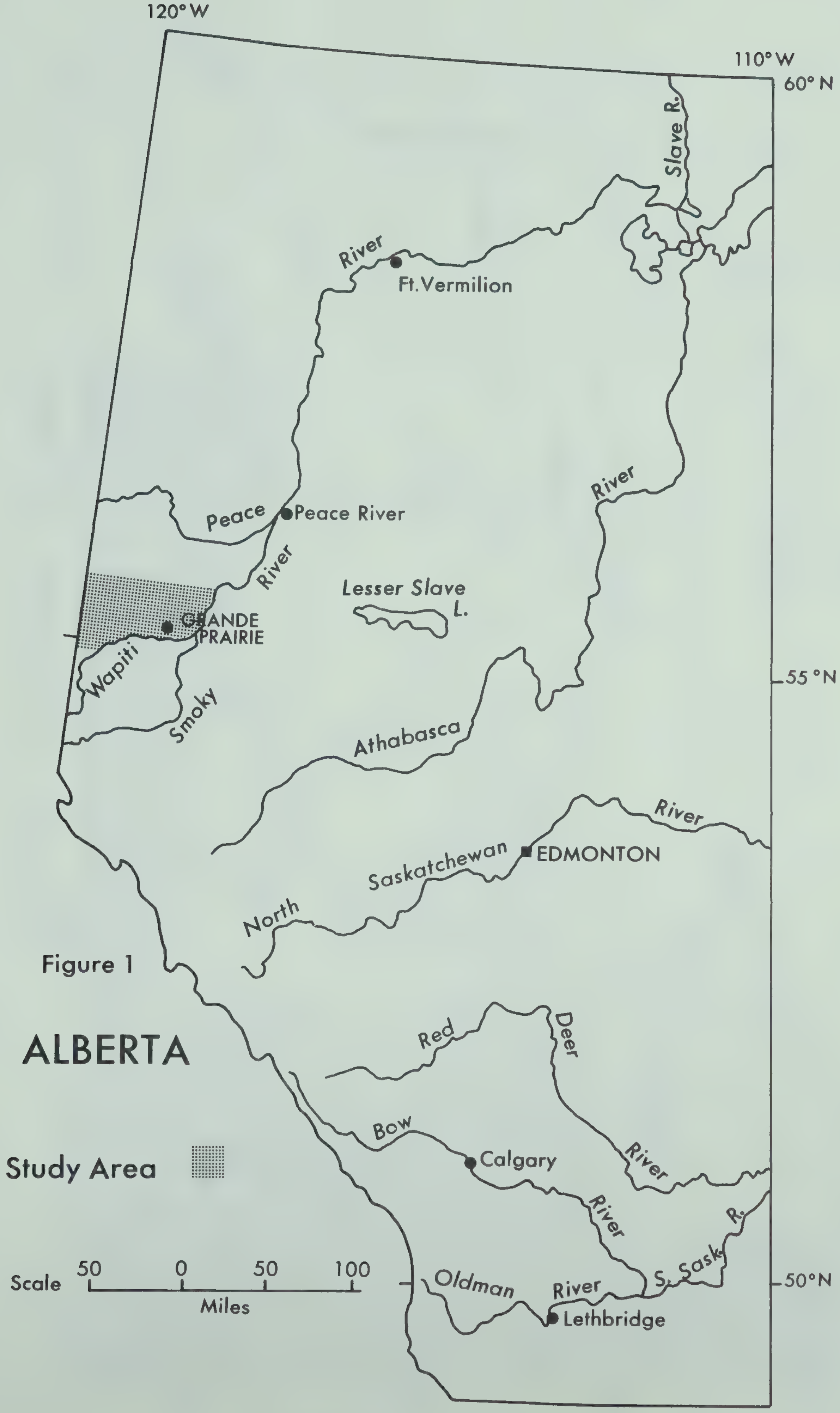
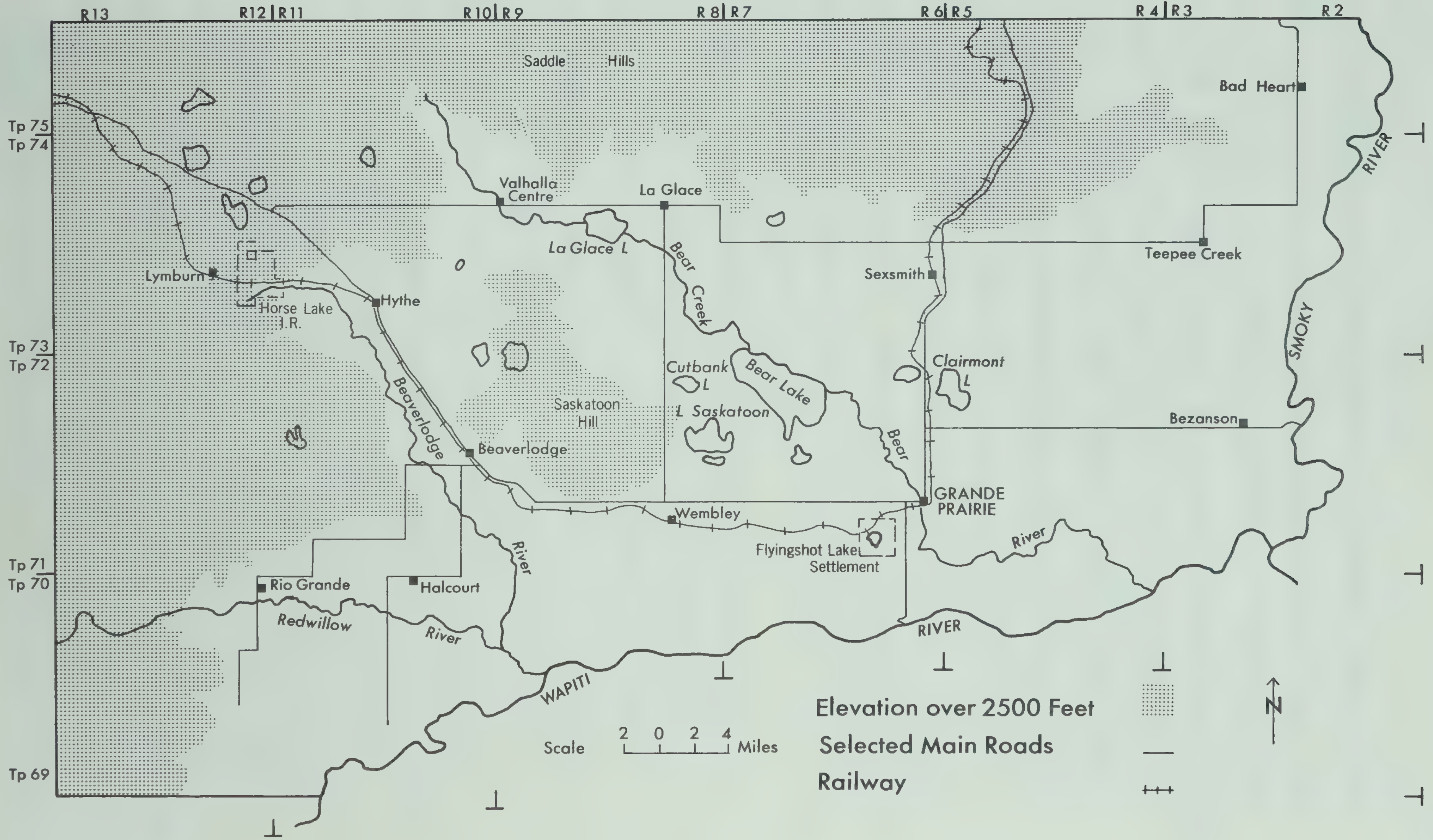

120° W
110° W
60° N
55 °N
50°N
Slave R.
River
Ft. Vermilion
Peace
Peace River
River
River
Lesser Slave L.
GRANDE PRAIRIE
Wapiti
Smoky
Athabasca
River
EDMONTON
Saskatchewan
North
Red
Deer
River
Bow
Calgary
River
S. Sask. R.
Oldman
River
Lethbridge
ALBERTA
Study Area ▨
Scale 50 0 50 100
Miles

Figure 1

Figure 2

LOCATION and PHYSICAL FEATURES



south respectively; the more rugged and heavily-timbered slopes of the Saddle Hills to the north; and a poorly-drained area to the west. In this respect the study area reflects the situation of the Peace region generally as it is separated from the rest of agricultural Alberta to the south and east by more than a hundred miles of non-arable land. This isolation facilitates analysis of the operation of locational factors. Perception of physical and locational advantages in the study area by the settlers was no doubt modified by experience in similar regions elsewhere, but, especially in early settlement, the farmers' choice of location was made according to a separate (although perhaps not new) set of regional references from which many of the locational influences of an adjacent settled region were eliminated.

In most of the physical characteristics, particularly the vegetative cover, the study area is quite representative of the so-called "park-land" belt that comprised the buffer zone between the original forest and grassland in Western Canada. In terms of physical locational factors then, it is reasonable to assume that those found operative in the study area did not differ significantly from those found in the larger parkland area in similar time periods. Thus at least some of the findings of this study can be extended validly to a much larger area.

Finally, the writer has a fairly thorough acquaintance with the history and geography of the area derived from several years' residence and interest and from past investigations into characteristics of its settlement.[1] It is recognized that there is a danger of such familiarity

---

[1] Tracie, C.J., Agricultural Settlement in the South Peace River Area. Unpublished M.A. thesis, University of Alberta, Edmonton, 1967, 91 pp.

leading to unfounded intuitive assumptions. It is hoped, instead, that prior experience will give direction in assessing the validity and reality of certain statistical implications in the analysis of the data.

B. Physical Characteristics

The study area shares most of the dominant physical characteristics of the larger Peace River region: a rather gently undulating surface; moderate relief of a few hundred feet except where the major rivers have incised deeply into the upland surface and where a few erosional remnants of an older till plain rise several hundred feet above the surrounding upland. Its original vegetation was characterized by a mixed grassland-forest cover ranging from open grassland through mixed grassland-forest to forest and poorly-drained swamp and muskeg, these generally coincident with the Degraded Black, Grey Wooded, Organic and Meadow soil zones respectively. Considering its northern location, it has an anomalous climate which allowed the development, perhaps optimistically, of a cereal crop agriculture.

The study area can be divided into two broad physiographic divisions: till plain remnants and lower-lying laking basins,* both of glacial and glacio-lacustrine origin, the latter considerably altered by the action of water and wind. Elevations range from fifteen hundred feet along the Smoky River to thirty-two hundred feet in the Saddle Hills. This suggests a greater relief than actually exists over most of the area however, as the upland surface is more consistently between two thousand feet and twenty-five hundred feet. The area is generally in a juvenile stage of erosion. Except in a few areas near the more prominent

---

*Basins formerly inundated by pro-glacial lakes.

till plain remnants, the slopes between the laking basins and the till plain remnants are long and fairly uniform. Steeply-sloping land inhibits cultivation in a few localized areas only. The gently undulating nature of the upland surface coupled with an incompletely developed drainage system is the cause of the many shallow lakes and ponds scattered over a large part of the area.

Drainage is effected by the Smoky River and its major tributary, the Wapiti, both incised as much as seven hundred feet below the upland surface. The Bad Heart, Beaverlodge, Red Willow and Bear Rivers are the main tributaries of these rivers in the study area. Glacial erosion and deposition have interrupted the pre-glacial drainage network and the present drainage system is only incompletely developed. This has led to fairly large areas of poorly-drained land, especially along the western portion of the study area. A large area of sand dunes of post-glacial origin along the north side of the Wapiti River also contains much poorly-drained land.

At the time of initial agricultural settlement one of the largest of the "prairies" in the Peace, the Grande Prairie, formed the core of the study area. Although exaggerated in size and in vegetative characteristics in early accounts, semi-open to open grassland covered a considerable part of the eastern section of the study area and extended west past Saskatoon Mountain into the Beaverlodge area. This area (approximately 400 square miles) consisted of open grassland interspersed with poplar (Populus tremuloides), willow (Salix spp.) and several kinds of low bushes, most common of which was probably the saskatoon bush (Amalanchier alnifolia). In the heart of the grassland area, these

would occur in isolated bluffs (clumps) and would increase to a semi-continuous cover in the direction of the forest periphery. A larger mixed-wood cover was found along creeks and rivers with white spruce (Picea glauca) and Balm of Gilead (Populus balsimifera) interspersed with the poplar.

Poplar was dominant over most of the rest of the area ranging in size from scrub (under 3 inches DBH*) to medium-sized timber (15-20 inches DBH) in favored areas. White spruce occurred inter-mixed with poplar in higher and better-drained areas, but was dominant in a few localities only. Birch (Betula papyrifera) and mountain alder (Alnus tenuifolia) occurred infrequently. Black spruce (Picea mariana), tamarack (Larix laricinia) and several varieties of willow were characteristic of the poorly-drained areas, while on the sandier soils spruce, jackpine (Pinus banksiana) and lodgepole pine (Pinus contorta var. latifolia) predominated. Although cultivation has erased most of the open and semi-open grassland, and fires have destroyed almost all of the "original" vegetation, the vegetative patterns and associations have changed relatively little over most of the non-cultivated land.

Soils are complex both in composition and in areal distribution. Although the area falls generally into the Grey Wooded soil zone, there are large areas of Black to Degraded Black soils derived in the main from the glacio-lacustrine deposits of the laking basins. In terms of terrain and natural fertility, these form the best agricultural land. The Grey Wooded and Dark Grey Wooded soils are derived predominantly from a till parent material. There is a general coincidence of Black or Degraded Black and Grey Wooded soils with the laking basins and the remnant till plains respectively. Similarly there is a general correlation between

---

*DBH refers to diameter at breast height.

the Degraded Black and Grey Wooded soils zones and the areas of semi-open grassland and forest land respectively. In addition, Organic and Meadow soils are found in areas of poor drainage.

Although early explorers and surveyors tended to exaggerate the mildness of the climate, no doubt because of the area's northern location, it is distinctly Continental with long, cold winters and short, warm summers. Frequently the winter's cold is punctuated by periods of short-term moderation due to the "chinook", a movement of adiabatically-warmed air from the mountains approximately eighty miles to the southwest. Long summer days, hot spells that occasionally raise the temperature into the nineties, and extended autumns tend to compensate for the short summers.

At Beaverlodge and Grande Prairie, daily temperatures range from mean minimum values in January of -1.2°F. and -5.9°F. to mean maximum values in July of 72.2°F. and 71.8°F. respectively.[2] The average frost-free season (days above 29°F.) is 130 and 112 days at Beaverlodge and Grande Prairie respectively.[3] Average annual precipitation is 17.3 inches at Grande Prairie and 17.9 inches at Beaverlodge.[4] While

---

[2] Canada, Department of Transport, Meteorological Branch, Climatic Normals (Vol. 1, Temperature), Toronto, 1968, pp. 17, 18, 30 and 31.

[3] Odynsky, W., A. Wynnyk and J.D. Newton, Reconnaissance Soil Survey of the Grande Prairie and Sturgeon Lake Sheets, Alberta Soil Survey, Report No. 18, Department of Extension, Un. of Alberta, 1956, p. 20. A difference of 18 days between stations only 20 miles apart may appear remarkable but Beaverlodge is ideally situated on a southeast facing slope while Grande Prairie is located in a lower area of poor air drainage.

[4] Canada, Department of Transport, Meteorological Branch, Climatic Normals, (Vol. 2, Precipitation), Toronto, 1968, pp. 37 and 38.

precipitation may appear marginal for grain cultivation, concentration (approximately 55 per cent of the total) during the growing season allows for adequate moisture in most seasons.

As is often the case, these averages conceal wide variations from year to year. At Beaverlodge in the 43-year period ending in 1958, the length of the frost-free period (days above 28°F.) varied between 70 days recorded in 1916 and 172 days in 1940, while the annual precipitation during this same period ranged from a low of just under ten inches in 1923 to nearly 25 inches in 1951.[5] A more detailed treatment of the climatic regimes of stations in the Peace area and a comparison of these and two stations from central Alberta will be found in Appendix B.

C. General Agricultural Settlement

Although very little is known about the impact of the first inhabitants on the study area, it would seem that the Indians' influence was significant in three aspects. First, if they were not responsible for the initiation of the "prairie" areas, as Dawson thought,[6] they at least contributed to the maintenance of them through the agency of

---

[5] Odynsky, W., et. al., Reconnaissance Soil Survey of the Beaverlodge and Blueberry Mountain Sheets, Alberta Soil Survey, Report No. 20, Department of Extension, Un. of Alberta, 1961, pp. 105-107.

[6] Dawson, G.M., "Report of An Exploration From Port Simpson on the Pacific Coast, to Edmonton on the Saskatchewan Embracing a portion of the Northern Part of British Columbia and the Peace River Country", Canadian Geological Survey, Report of Progress 1879-1880, Dawson Brothers, Montreal 1881, p. 68B.

fire. Secondly, many of their trails were improved by later white settlers and became the basis for parts of the transportation network. Thirdly, their presence in considerable numbers on the Grande Prairie led to the establishment of a trading post at Cutbank Lake in 1881 near present-day Lake Saskatoon. Other trading posts had been established much earlier along the Peace River but this was the first permanent white settlement in the study area. Although most of these posts attempted some form of agriculture, and a few grew limited amounts of grain, settlement based on agriculture did not appear until the turn of the Twentieth Century.

Early sporadic settlement gave way to a definite sustained movement into the study area beginning about 1909. There were several factors involved in this initial wave of settlement. An active immigration campaign by the Canadian government coupled with an increasing scarcity of good agricultural land in the United States resulted in a massive influx of settlers into the Prairie Provinces in the two decades just before and just after the turn of the century.[7] By the end of the latter decade the better land had been occupied in the more accessible central areas of the Prairies and attention was directed to the last large reserve of arable land - the Peace River region. This interest was encouraged by a spate of promotional literature based on selected statements and opinions of early surveys and from some rather atypical experiences of successful farmers in the area. These accounts generally

---

[7] Lower, A.R.M., Colony to Nation, Longman's, Green & Co., Toronto, 1951, p. 420.

ignored or rationalized any climatic hazards and consistently exaggerated the extent of the open grasslands and other attractions of the Peace area.

By 1908 there were a few families in the study area, mainly in the Lake Saskatoon-Beaverlodge area and near Flyingshot Lake. The federal government began land subdivision surveys in 1909 (the federal Department of the Interior having jurisdiction over the provincial natural resources until 1930) and by 1912, the bulk of the study area had been surveyed. 1910 marked the beginning of the first major influx of settlers. The rate of agricultural expansion reached a peak in 1911 with the improvement of access into the area, but active expansion continued until 1919.[8] There was a fairly large movement of settlers into the area immediately after World War I but in the main this was to land that had been abandoned during the war and led to little new expansion.

A second major expansion took place in the years 1927 to 1930. The movement in the first part of this period was in response to a buoyant national economy, high wheat prices and a succession of several bumper crops in the Peace region. Expansion in the latter part of the period occurred as drought-stricken farmers from the southern Prairies moved into the Peace area.

---

[8] Statements regarding the rate of agricultural expansion are based on the number of entries on land not previously occupied in each year. Consequently while the entries represent the rate at which new agricultural land was being occupied, they do not represent entirely the movements of population in to and out from the study area.

These were joined by many city-dwellers who hoped to find security and a better living on farms in the Peace.

Since that time new agricultural expansion in the study area has been slow. Periods of relative inactivity occurred during World War II and the decade of the fifties and into the early sixties. Some expansion took place immediately after World War II and in the mid-sixties but this was relatively insignificant in the overall process. Only 145 new entries have been recorded in the past decade (1959-1968), 112 of which occurred in the years 1963-1966 inclusive, as compared with 4637 entries in the decade 1910-1919.[9] Some 25 per cent of the land in the study area has never been occupied (of which about half is presently withdrawn from agricultural settlement) and an additional seven per cent has been occupied at one time but is presently abandoned.

Most of the 12 or 13 per cent of the land presently restricted from settlement was withdrawn in the early fifties. This reflects the rather tardy concern on the part of the government in allocating only land suitable for agricultural settlement. While methods of land entry and alienation have changed through time from the "free" homestead[10] to homestead leases and homestead sales, the policy of

---

[9] Unless otherwise noted, all statements concerning number of entries or rates of expansion are based on the entries in the Township General Registers, Department of lands and Forests, Edmonton.

[10] The designation "free" homestead is not strictly true; a ten dollar registration fee was required of the homestead applicant. Homestead leases and sales were based on a purchase price set by land assessment. In the former case lease payments were made on a share-crop basis with an option to purchase after ten years. In homestead sales the assessed price was paid in a maximum of nineteen annual instalments.

making land available somewhat indiscriminantly has only recently given way to a more controlled settlement policy. It is true that settlement was directed in a very broad sense by the areas chosen to be surveyed, and later attempts on the part of the provincial government were made to reserve certain areas of unsuitable land by means of timber and watershed controls, but firm control over restriction of certain lands became effective only in the last fifteen to twenty years. It is interesting to note that in a few places within this now restricted area, settlers of the thirties attempted to utilize the land but were forced quickly to the realization that the land was not capable of agricultural settlement, a conclusion that the government did not confirm until twenty years later. As was so often the case, in the final analysis, the individual farmer tested the limits of agricultural capability and in subsequent settlement controls the government only formalized the boundaries already determined.

CHAPTER III

LAND ENTRY AND VEGETATIVE COVER

A. Material

Two sets of data were needed for the analysis of the association between the time of settlement and the vegetative cover at the time of settlement: information about the location and date of settlement of each unit of land; and a detailed reconstruction of the vegetative cover at the time of settlement, preferably on a quarter-section basis.

The first set of data was obtained from the Township General Registers, both original and current, located in the Alberta Department of Lands and Forests, Edmonton. For each quarter-section of land entered upon (*i.e.* an application made to own or lease the land for agricultural purposes) these registers give: date of initial entry and any subsequent entries; kind of entry (homestead, lease, sale etc.); the number, and in many cases, the dates of any cancellations; the name of the person making application; the date of the patent (issue of title) if applicable. In addition any permanent restrictions on agricultural settlement are noted on unoccupied land.

In this study the major emphasis is upon the initial entry on each quarter-section as it indicates the priority attached to it in the general agricultural settlement of the area. An additional qualification is that only entries leading to alienation (ownership) of the land are considered. Grazing leases, cultivation permits and the like consequently are not considered as entries. Once the unit of land has been entered

upon it is not considered in succeeding time periods even if the initial entry proved unsuccessful and subsequent entries were made. The reason for this is two-fold. First, as any improvements on the land made by the unsuccessful entrant may have exerted a positive influence on the choice of location by subsequent entrants, the exclusion of subsequent entries allows the analysis to be directed more clearly to the three variables under consideration. Secondly, such subsequent entries detract from the primary emphasis of this study which is to determine factors in priority of location choice.

The time span of agricultural settlement (1908-1968) has been divided into fifteen time periods: 1) 1908-1910; 2) 1911; 3) 1912; 4) 1913; 5) 1914; 6) 1915; 7) 1916; 8) 1917; 9) 1918; 10) 1919; 11) 1920-1927; 12) 1928; 13) 1929; 14) 1930; 15) 1931-1968. The variation in the length of the time periods, especially with regard to time period 15, is undesirable but this division is necessary in order to equalize approximately the number of entries in each time period (see Table 3.1). A more orderly division of the time span into historically significant sections results in such a gross discrepancy in the number of entries in the time periods as to make any statistical treatment of them by the chi-square test meaningless. Since the time units are single years for the most part, the results of the statistical analysis can be consolidated quite easily into more meaningful subdivisions in any case. An historical account of the process of settlement will be given in some detail following the analysis of the variables in farm location.

Reconstruction of the vegetative cover at the time of settlement on a quarter-section basis entailed a more indirect approach. Sources such as Moss' work in the Peace[1] or even the vegetation notes on the published township plans lacked the detail necessary for this study. Fortunately, the surveyors' original notebooks have been preserved by the Alberta Department of Highways. These books contain notations on the vegetative cover, recorded in a systematic way along the line of survey. These notations are given in considerable detail including the kind, and some indication of the size, of the vegetative cover. This information was recorded on north-south transects which were run at one-mile intervals and on east-west transects which were run at two-mile intervals.

For this study the notations were transferred to the appropriate section lines on blank township plans. Utilizing the proportions of various kinds of vegetation along the north-south transects on a half-mile basis, the vegetation was then classified according to the following system:[2]

Class 1	Grassland	80% or more grassland
Class 2	Groveland	60-79% grassland
Class 3	Transitional groveland	40-59% grassland

---

[1] Moss, E.H., "Grasslands of the Peace River Region, Western Canada", Can. Journ. of Botany, 30, 1952, pp. 98-124.

[2] Appreciation is expressed to Dr. G.H. LaRoi, Department of Botany, University of Alberta, and to Dr. H. Vaartnou, Supervisor, Plant Pathology Crop Protection and Pest Control, Department of Agriculture, Government of Alberta, for their valuable comments and suggestions regarding the classification system.

Class 4	Parkland	20-39% grassland
Class 5	Scrub land	less than 20% grassland; trees 3 inches or less DBH
Class 6	Forest land	less than 20% grassland; trees greater than 3 inches DBH
Class 7	Poorly-drained (open)	50% or more indicated as poorly-drained and predominantly (more than 50%) open
Class 8	Poorly-drained (treed)	50% or more indicated as poorly-drained and predominantly (50% or more) treed
Class 9	No information	unsurveyed; or, more than 75% of the transect occupied by open water

This classification system is specifically formulated on the proportionate amounts of two basic kinds of vegetative cover, namely grassland and trees. It was felt that this type of classification would have the most significance in identifying the sequence of farm choice priorities through time and would be the most clearly perceived by the farmer as having desirable or undesirable characteristics.

Classification of the vegetation was then generalized to the quarter-section on either side of the half-mile portion of the transect involved, utilizing only the north-south transects to insure uniformity of information for each unit of land. In this way the vegetative cover of approximately 95 per cent of the study area was reconstructed on a quarter-section basis (see Figure 3).

More detail was provided by the addition of two sub-categories indicating the kind of trees involved (deciduous - 60% or more deciduous; mixed-wood - 40-59% of either deciduous or coniferous; coniferous - 60% or more coniferous) and whether the area had been burned over recently or not. Although neither of these additional items of information is used directly in the analysis of settlement

TABLE 3.1

Entries in Each Time Period According To Vegetation Category*

Time Period		Vegetation									
		1	2	3	4	5	6	7	8	9	Total
1	(1908-1910)	234	59	41	14	13	11	1	0	2	375
2	(1911)	470	186	104	49	58	34	2	1	5	909
3	(1912)	150	73	52	34	90	56	13	4	9	481
4	(1913)	92	44	57	39	70	57	3	2	3	367
5	(1914)	50	48	57	41	96	38	3	0	3	336
6	(1915)	48	36	67	62	81	68	5	5	1	373
7	(1916)	25	29	42	58	140	142	6	9	1	452
8	(1917)	9	10	16	47	191	187	1	12	4	477
9	(1918)	5	4	12	25	119	130	97	15	1	408
10	(1919)	3	1	10	28	196	194	7	23	4	466
11	(1920-1927)	8	2	16	26	180	220	12	38	6	508
12	(1928)	43	22	19	22	266	413	4	30	4	823
13	(1929)	2	1	0	7	209	272	4	32	3	530
14	(1930)	0	0	0	0	98	276	3	38	16	431
15	(1931-1968)	19	12	11	10	103	348	4	43	19	569
Unentered		4	3	7	18	378	1110	11	164	546	2241
											9746

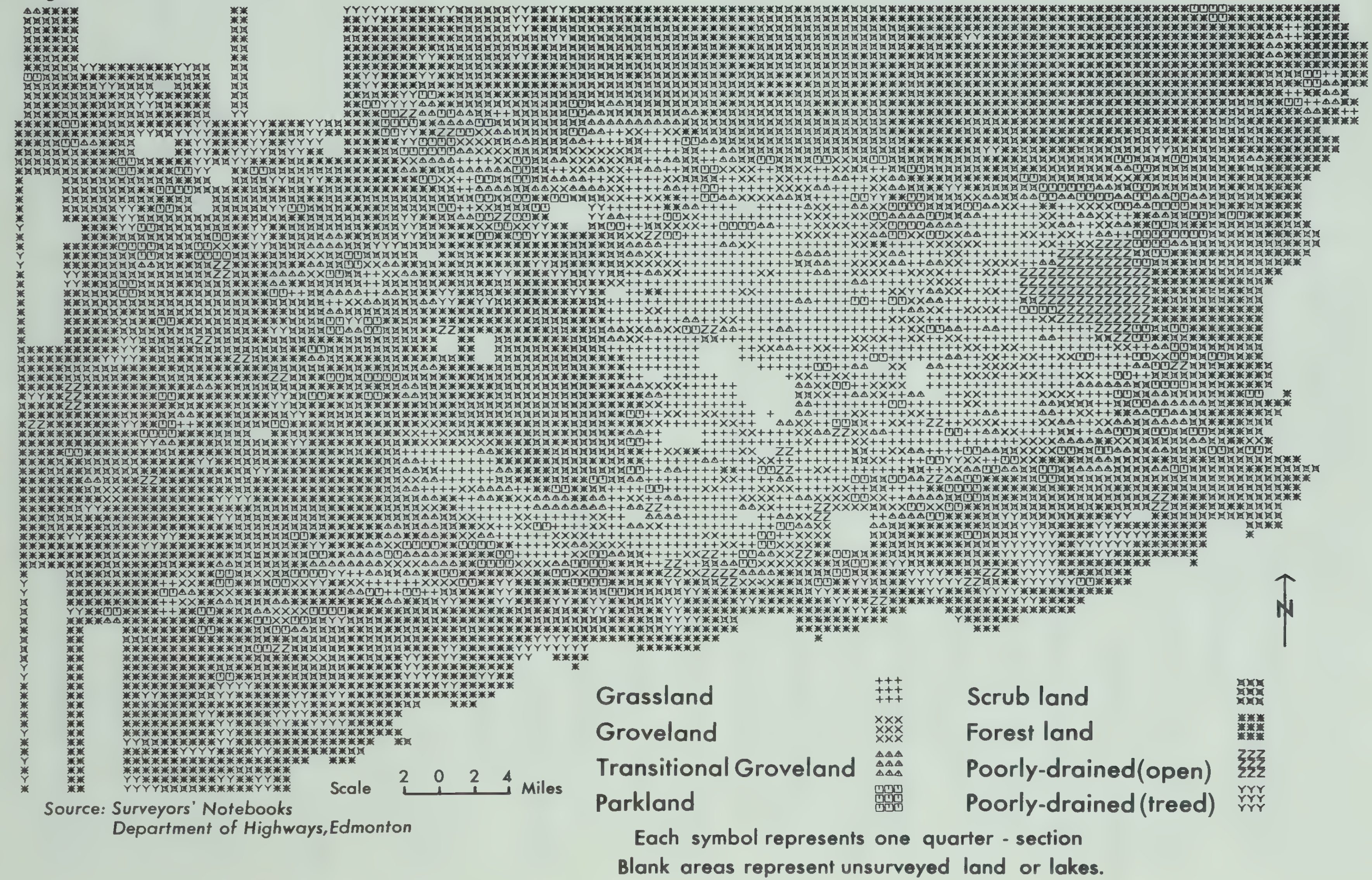
Vegetation Categories:
1 - grassland
2 - groveland
3 - transitional groveland
4 - parkland
5 - scrub land
6 - forest land
7 - poorly-drained (open)
8 - poorly-drained (treed)
9 - no information

*Refers to entries on previously unoccupied land only

Source: Township General Registers, Alberta Department of Lands and Forests, Edmonton

Figure 3

VEGETATION About 1910


Scale
2 0 2 4 Miles
N
Grassland +++
Groveland XXX
Transitional Groveland ΔΔΔ
Parkland
Scrub land
Forest land
Poorly-drained (open) ZZZ
Poorly-drained (treed) YYY
Each symbol represents one quarter - section
Blank areas represent unsurveyed land or lakes.

*Source: Surveyors' Notebooks
Department of Highways, Edmonton*

and vegetative cover, the detail provided by their inclusion makes the vegetation reconstruction more meaningful and allows general statements to be made about their effect on the process of settlement.

The question arises as to whether the vegetation at the time of survey is the same as the vegetation at the time of settlement, especially in cases where these two events are separated by decades. While recognizing that natural modification of the vegetative cover was no doubt operative in the study area by trees invading prairie areas, and by fire, it is felt that over the majority of the area, such modifications were not significant in affecting the direction of the settlement process. In the context of this study, then, vegetation at the time of survey is considered to be the same as vegetation at the time of settlement.

The amount of land available to the settler in each vegetation category in each time period must be known also, for without this information the chi-square test cannot be applied. Theoretically the whole of the unoccupied area was available from the initial time period as no legal restriction upon occupying unsurveyed land existed. Technically, however, an entry date could not be recorded until the land was legally surveyed, consequently the entry date, by which priority of location is determined, could not pre-date the date of survey. Thus, within the framework of this study, the date of survey becomes a technical restriction on the amount of land available to the intending settler (see Table 3.2).

Other parcels of land were unavailable to the settler for other reasons. The Horse Lake Indian Reserve in Township 73 Range 12 and the

Flyingshot Lake Settlement[3] in Township 71 Range 6 were unavailable for settlement over the entire time span. Lands withdrawn from settlement for park purposes or because the land was judged unfit for agriculture have been noted also in the compilation of Table 3.3. The availability of school lands (usually sections 11 and 29 in each township) is more difficult to assess. Restricted from settlement initially, they were subsequently made available but at different times and on an individual basis. When the farmers of an area presented a reasonable case for having these school lands made available, the government put the land up for public auction.[4] As a consequence of this policy, the dates at which certain school lands became available varied widely. Since the disposition of this land awaited local pressure, the first entry date recorded for the land usually indicates the date of availability, but it does not follow that the land was restricted until that time, only that local pressure was not great enough to encourage a public auction. Another complicating factor is that in some cases land other than the designated sections was chosen for school land and the dates when these transfers were made are unavailable. For these reasons school lands are treated as though they were available throughout the time span.

---

[3] This block of land was surveyed in 1907 according to special regulations. Called a "settlement survey" its purpose was to insure that the people already settled there (primarily Metis) gained title to the land they were occupying. This land was not available to later settlers except through purchase.

[4] Although a few acres of the school section was often used for the location of a school, these lands were set aside primarily to provide revenue for the local school. This was accomplished either by leasing or selling the land to local farmers.

Table 3.3 sets out the amount of land in each vegetation category that was available to the intending settler in each time period.

TABLE 3.2

Lands Made Available by Survey (in number of quarter-sections)

Survey Date	Vegetation category									
	1	2	3	4	5	6	7	8	9	Total
1910 & prior	1056	444	385	350	1257	1371	74	191	152	5280
1911	0	0	0	0	40	364	0	4	0	408
1912	76	63	76	51	627	242	0	13	8	1158
1913	10	6	2	6	42	204	84	73	1	428
1914	8	12	24	46	53	604	6	86	0	839
1916	0	0	0	6	12	138	0	0	0	156
1917	12	0	16	8	73	205	0	2	8	324
1919	0	0	0	0	1	10	0	1	0	12
1920	0	0	6	8	164	410	8	42	25	663
1930	0	4	2	0	8	4	0	2	0	20
Unsurveyed	0	1	0	5	11	4	4	0	433	458*
Totals	1162	530	511	480	2288	3556	176	416	627	9746

*Horse Lake Indian Reserve (25 quarters) was surveyed so the vegetation is given, however it is treated as unsurveyed as the land was not open to settlement.

B. Analysis

In analysis of the association between settlement and vegetative cover by the use of the chi-square test, the null hypothesis in all cases is: the farmers' choice of location was not influenced by the type of vegatative cover on the land unit at the time of settlement, therefore the frequency with which he chose land in each vegetation category was determined by chance *i.e.* in proportion to the amount of land available

TABLE 3.3

Land Available in each Time Period According to Vegetation Category (in quarter-sections)

Time Period		Vegetation Category								
		1	2	3	4	5	6	7	8	Total
1	(1908-10)	1056	444	385	350	1257	1371	74	191	5128
2	(1911)	823	385	344	336	1284	1724	73	195	5164
3	(1912)	428	262	315	338	1853	1932	71	209	5408
4	(1913)	288	197	265	310	1807	2090	142	278	5377
5	(1914)	204	163	232	317	1788	2637	145	362	5848
6	(1915)	154	115	175	276	1692	2599	142	362	5515
7	(1916)	106	79	108	220	1625	2669	137	357	5301
8	(1917)	93	50	82	170	1556	2722	131	350	5154
9	(1918)	84	40	66	123	1365	2535	130	338	4681
10	(1919)	79	36	54	98	1247	2415	33	324	4286
11	(1920-27)	76	35	51	78	1215	2631	34	343	4463
12	(1928)	68	33	35	52	1035	2410	22	305	3960
13	(1929)	25	11	16	30	769	1997	18	275	3141
14	(1930)	23	14	18	23	568	1729	14	245	2634
15	(1931-68)	23	14	18	23	470	1453	11	207	2219

Vegetation Categories:
1 - grassland
2 - groveland
3 - transitional groveland
4 - parkland
5 - scrub land
6 - forest land
7 - poorly-drained (open)
8 - poorly-drained (treed)

in each vegetation category (see Tables 3.3 and 3.4).

1. General Associations

In a hypothetical study area where the vegetation did exert a positive or negative influence on the farmers' choice of location, one would expect that the incoming settlers would choose the "better" land (in terms of vegetation) with much greater frequency than would be expected under "chance" circumstances. A chi-square test applied to these first time periods would yield large values. In later periods, however, the rapid depletion of the "better" land would narrow the range of choice available to the settler, and he would be forced onto increasingly poorer land. As the farmers' choice narrows, it may be hypothesized that they will become increasingly indifferent to apparent differences in the vegetation, and become more concerned with other locational variables. If this was the case then it would be reasonable to expect farmers to choose land in proportion to the amount that was available in each vegetation category. A chi-square test computed under these circumstances would yield a small value. In the hypothetical case then, one would expect that the chi-square test would yield declining values in a rather even pattern as one proceeds from the initial time period to the end.

There are several factors that will upset this rather even pattern of decreasing chi-square values however. a) Unless all of the land in the study area is available to the settler from the initial time period, the chi-square value of a particular time period can be inflated by the release of previously restricted lands to settlement. This is

particularly true if such land occurs in the more favorable vegetation categories. b) The rather even decline of chi-square values in the hypothetical case assumes a fairly consistent number of entries in each time period. Where the number of entries varies widely, wide variations in the chi-square values can be expected as well, even though the same level of association between settlement and vegetation is maintained. All other conditions being equal, the chi-square value will double as the population or sample is doubled. c) An abrupt change in the farmers' perception of what is favorable or unfavorable vegetation is another factor that would upset this pattern. Such a change, especially in the early part of the time span where large amounts of all types of vegetation were available, would interrupt the decline of chi-square values. The change in perception would result in a rush of settlers to land that previously had been considered unfavorable and thus chi-square values would tend to become quite large again. Probably the best examples of such a change in perception would have occurred in areas in the Eastern United States having significant amounts of both prairie and woodland and which were settled about the time when locational preference shifted from woodland to prairie.

Turning to the study area, Table 3.5 gives the pattern of chi-square values over the time span under consideration, as well as the category values (the values which, when summed, give the chi-square value). Table 3.1 gives the observed frequencies (number of entries) arranged according to vegetation category and Table 3.4 gives the expected frequencies (number of entries expected under the conditions

TABLE 3.4

Expected Frequency* of Entries According to Vegetation Category

Time Period		Vegetation Category								
		1	2	3	4	5	6	7	8	Total**
1	(1908-10)	76	32	28	26	91	99	6	13	371
2	(1911)	144	63	58	58	224	300	13	36	896
3	(1912)	37	23	27	27	158	162	7	18	459
4	(1913)	20	13	18	20	122	142	9	18	362
5	(1914)	12	10	13	18	102	150	8	20	333
6	(1915)	11	7	11	19	113	174	9	24	368
7	(1916)	9	7	9	18	138	228	11	30	450
8	(1917)	9	5	7	17	142	251	12	33	476
9	(1918)	8	4	6	10	118	220	12	28	406
10	(1919)	9	5	7	12	134	261	5	35	468
11	(1920-27)	8	5	5	8	136	296	5	38	501
12	(1928)	12	8	8	12	213	500	4	61	818
13	(1929)	5	3	3	5	129	335	3	45	528
14	(1930)	4	2	2	4	89	272	2	39	414
15	(1931-68)	6	3	6	6	116	360	3	52	552

Vegetation Categories:
1 - grassland
2 - groveland
3 - transitional groveland
4 - parkland
5 - scrub land
6 - forest land
7 - poorly-drained (open)
8 - poorly-drained (treed)

*Under conditions imposed by the null hypothesis.

**Discrepancies between the totals in this column and those of Table 3.1 are due to rounding and to the fact that some entries were made on land either unsurveyed or with no vegetation category (Category 9 of Table 3.1).

TABLE 3.5

Category and Chi-square Value - Vegetation and Land Entry*

Time Period		Vegetation Category								
		1	2	3	4	5	6	7	8	Chi-square
1	(1908-10)	+324.3	+22.8	+5.1	-5.5	-66.8	-78.2	-4.2	-13.0	519.9
2	(1911)	+711.1	+236.2	+36.5	-1.4	-123.0	-235.8	-9.3	-34.0	1387.3
3	(1912)	+345.1	+100.2	+23.1	+1.8	-31.0	-83.1	+5.1	-12.5	601.9
4	(1913)	+259.2	+73.9	+84.5	+18.0	-22.2	-52.1	-4.0	-14.2	528.1
5	(1914)	+120.3	+144.4	+148.9	+29.4	-0.4	-83.6	-3.1	-20.0	550.1
6	(1915)	+124.4	+120.1	+285.1	+97.3	-10.2	-64.6	-1.8	-15.0	718.5
7	(1916)	+28.4	+69.1	+121.0	+93.4	0.0	-32.4	-2.3	-14.7	361.3
8	(1917)	0.0	+5.0	+11.6	+52.9	+16.9	-16.3	-10.1	-13.4	126.2
9	(1918)	-1.1	0.0	+6.0	+22.5	0.0	-36.8	+602.1	-4.4	672.9
10	(1919)	-4.0	-3.2	+1.3	+21.3	+28.7	-17.2	+0.8	-4.1	80.6
11	(1920-27)	0.0	-1.8	+24.2	+40.5	+14.2	-19.5	+9.8	0.0	110.0
12	(1928)	+80.1	+24.5	+15.1	+8.3	+13.2	-15.1	0.0	-15.8	172.1
13	(1929)	-1.8	-1.3	-3.0	+0.8	+49.6	-11.8	+0.3	-3.8	72.4
14	(1930)	-4.0	-2.0	-2.0	-4.0	+0.9	+0.1	+0.5	0.0	13.5
15	(1931-68)	+26.5	+27.0	+4.2	+2.7	-1.4	-0.3	+0.3	-1.6	64.0

Vegetation Categories:
1 - grassland
2 - groveland
3 - transitional groveland
4 - parkland
5 - scrub land
6 - forest land
7 - poorly-drained (open)
8 - poorly-drained (treed)

*Since category values involve squaring the difference between the observed and expected frequencies, sign values are always positive. The use of positive and negative signs in the table only indicates the direction of the departure from the expected frequency i.e. whether the value results from more land (+) or less land (-) than expected being chosen in a particular category.

imposed by the null hypothesis) arranged the same way. Together these tables provide the basic material from which the chi-square values are calculated. Table 3.3 gives the amount of land available to the farmer in each time period according to the vegetation category. It is from the proportions of available land in each vegetation category that the expected frequencies of Table 3.4 are calculated.

First of all it should be noted that all chi-square values are significant at the .001 level, with the exception of time period 14 (1930) which is not significant. This piece of statistical terminology implies that there is only one chance in one thousand that a relationship of the type observed could have happened by "chance". We can reject therefore the null hypothesis with 99.9 per cent certainty in all but the one period, and conclude that an association between location choice and vegetative cover is virtually assured. In other words, the farmer viewed the vegetative cover as having favorable or unfavorable characteristics which, in turn, positively or negatively affected his choice of farm location.

Since the vegetation was perceived in this manner, it is expected that the set of chi-square values in the study area would follow generally the pattern noted in the hypothetical case, which indeed it does. The abnormalities in the pattern can be explained by reference to the three disruptive factors mentioned previously. The first factor (a) affects the chi-square values of Table 3.5 as the survey released lands to settlement that had been previously restricted technically. This was particularly true in the time periods up to 1920 when most

of the surveying was being done. The clearest example is provided by time period 12 (1928) however. Here the release of certain school lands, including several quarter-sections of the most preferred land, resulted in an abnormally large chi-square value in the time sequence.

The second factor (b) has particular application to time periods 2 (1911) and 12 (1928). While it is impossible to prove that, had the number of entries in these time periods approximated those of the other periods, the chi-square values would have fitted into the hypothetical pattern, it seems reasonable to assume that the relatively large number of entries (more than double those of many of the time periods) in these periods has inflated the chi-square values.

It would appear that the third factor (c) was operative in the abnormally high chi-square value for time period 9 (1918) when open poorly-drained land was being chosen much more often than expected. This excessively high value was however the result of one man's purchase of a large block of marsh land for grazing purposes.[1] The drainage network involved in making this land usable necessitated a large capital outlay, something that was beyond the reach of most individual farmers. Although the number of quarter-sections involved in this case was over eighty, it remains an individual case and can hardly be taken to represent a change in the farmers' general perception of the vegetation.

2. Specific Associations

Having established that there is a significant association between selection of farm location and vegetative cover, the next problem is to identify more specifically the kinds of vegetation that exerted a positive influence on location choice and those that exerted a negative

---

[1] This land was located around Kleskun Lake, east of Sexsmith.

influence. Although the results reported in Section 1 give some evidence that the farmers' perception of certain types of vegetation as favorable or unfavorable remained constant through time, a more detailed analysis of this question is necessary also.

One method of gaining insight into these problems is to use the category values of Table 3.5 as indicators of the relative importance of choice in different vegetation categories in the total association of a particular time period. For a specific time period, the larger the chi-square value the more likely there is to have been a significant association between the variables involved. Since the chi-square value is the sum of the category values, the size of a particular category value becomes an indicator of the relative importance of that category in the total association. Positive category values indicate that the settler chose that type of land more frequently than one would expect by chance; the higher the value, the more abnormal the frequency of choice. In the same way negative category values indicate that land of that type is being chosen at a lower frequency than would be expected. The following general points arise from a consideration of Table 3.5, focusing particularly on vegetation categories 1 to 6.

1) There is a clear indication as to what kind of vegetative cover was regarded as favorable and what was regarded as unfavorable. The high positive category values attached to grassland in the first periods were overlapped and finally supplanted by high values in the groveland category which in turn gave way to a preference for the transitional groveland and so on through to a slight positive preference for forest

land in the last time period. The interruption of this general pattern, particularly in time period 12 (1928) has already been mentioned. Actually the preference for the grassland and groveland areas of the land released in this latter period strengthens the general conclusion that grassland was viewed as preferable to scrub or forest cover. One could go further and say that, in terms of vegetation, the less grassland a unit of land contained, the lower its priority in choice of location.

2) The transfer of choice preference from grassland to groveland and from groveland to transitional groveland and so on in a sequential manner as time elapsed indicates that the perception of grassland and forest as favorable and unfavorable remained remarkably constant throughout the time span. Again, the departure from the regular pattern in time period 12 (1928) reinforces this conclusion. The exception with regard to time period 9 (1918) has been discussed above. The anomalous values of time period 15 (1931-1968) result from more complex factors. Part of the explanation lies in the release of school lands as noted for 1928: the extension of the road network likely made accessible lands that were viewed favorably from a vegetation standpoint but which previously were too far from transportation routes. This last possibility will be considered in detail in the following chapter.

3) Poorly-drained land remained the least-preferred land throughout the time span. This was especially true of the treed poorly-drained land. The exception in 1918 has been explained and it seems the drainage involved in making this land usable reached beyond this block of land.

Many of the choices of poorly-drained open land in time period 11 (1920-1927) occurred in this area as well.

4) The fact that not all the grassland was chosen before groveland began to be chosen and so on, points to the fact that other variables in the determination of location were operating as well. It is possible also that all boundaries between vegetation categories were not considered equally important in the farmers' evaluation of the vegetation.

Recognition of the high level of association between vegetation and choice of settlement location, and identification of the general patterns of choice and avoidance as related to the kinds of vegetative cover still does not present the entire picture. It is important to determine whether the farmer discriminated between the various vegetation categories and whether this discrimination was more important in some categories than in others. These objectives can be accomplished by employing the chi-square test on pairs of vegetation categories within each time period, using the same null hypothesis as before. Table 3.6 sets out these values and indicates the level of significance of the association. A chi-square value significant at the .02, .01 or .001 level indicates that there is only one chance in 50, 100 or 1000 that the farmer is not discriminating between the two categories involved. In other words the farmer is choosing one of the categories at a much higher rate than would be expected if no discrimination were involved. Conversely, where the level of the association is not significant, the farmer is choosing land from each category at about

TABLE 3.6

Chi-square Values of Paired Vegetation Categories (level of significance bracketed)

Time Period		Vegetation Categories				
		1&2	2&3	3&4	4&5	5&6
1	(1908-10)	12.0(.001)	1.5(NS)	10.6(.01)	13.7(.001)	0.2(NS)
2	(1911)	1.2(NS)	17.9(.001)	19.1(.001)	41.5(.001)	16.0(.001)
3	(1912)	3.2(NS)	7.4(.01)	5.7(.02)	14.0(.001)	14.4(.001)
4	(1913)	3.7(NS)	0.0(NS)	7.0(.01)	38.8(.001)	3.8(NS)
5	(1914)	0.7(NS)	0.7(NS)	10.7(.01)	22.4(.001)	54.7(.001)
6	(1915)	0.0(NS)	1.0(NS)	9.4(.01)	102.8(.001)	11.3(.001)
7	(1916)	2.8(NS)	0.0(NS)	1.5(NS)	54.8(.001)	16.4(.001)
8	(1917)	2.9(NS)	0.0(NS)	1.2(NS)	24.5(.001)	32.1(.001)
9	(1918)	0.5(NS)	1.1(NS)	0.1(NS)	15.4(.001)	18.1(.001)
10	(1919)	Ins. Data	3.6(NS)	1.1(NS)	7.7(.01)	45.2(.001)
11	(1920-27)	0.4(NS)	5.9(.02)	0.1(NS)	17.3(.001)	33.7(.001)
12	(1928)	0.0(NS)	0.4(NS)	1.0(NS)	6.5(.02)	26.9(.001)
13	(1929)	Ins. Data	Ins. Data	Ins. Data	0.4(NS)	56.2(.001)
14	(1930)	Ins. Data	Ins. Data	Ins. Data	4.2(.05)	0.5(NS)
15	(1931-68)	0.0(NS)	0.7(NS)	0.7(NS)	5.2(.05)	0.5(NS)

N.S. - not significant

Ins. Data - insufficient data (expected frequency in one of the two categories is less than five

the rate that would be expected by chance. This demonstrates that the farmer regards the differences between the two categories of vegetation as inconsequential, or at least secondary to other locational considerations.

Several points may be made from a consideration of this table. Discrimination between the grassland categories (categories 1 through 4) disappeared quite early in the time span while discrimination between parkland and scrub and between scurb and forest persisted until near the end of the time span. Although the farmers tended to regard the grassland categories with decreasing preference from grassland to parkland, the distinctions between these categories became unimportant quite quickly. The broad distinction between grassland and scrub or forest cover was important for almost the whole time period however.

There is a tendency for discrimination to disappear in each of the pairs of categories as one progresses through time. In large part this is due to the decreasing amount of preferred land and the transfer of preference to the next vegetation category in the sequence. Relating this to the foregoing item it is interesting to note that discrimination between grassland and groveland disappeared very quickly (in the second time period), between groveland and transitional groveland discrimination did not disappear until 1913, between transitional groveland and parkland not until 1915, and between the categories in the last two pairs not until 1929 and 1930 respectively. Generally then the less favorable the land in terms of the vegetation, the longer the discrimination between the categories persisted. To reiterate, where

the land contained a considerable amount of grassland, the boundaries between the categories were viewed as less important than the boundaries involved in the categories where grassland and scrub or forest was involved.

Summary

In order to test the association between choice of settlement location and vegetative cover, farm entry dates and amount of available land were classed into fifteen time periods covering the period 1908-1968, the period of agricultural settlement. Vegetation at the time of settlement was reconstructed and classified into nine categories. The chi-square test was then used to test and analyze the association, the null hypothesis being: the farmers' choice of location was not influenced by the type of vegetative cover on the land unit at the time of settlement, therefore the frequency with which they chose land in each vegetation category was determined by chance *i.e.* in proportion to the amount of land available in each vegetation category. This test was applied to all vegetation categories in each time period and then to pairs of vegetation categories in each time period. The major findings can be summarized in the following points:

1) The null hypothesis can be rejected at the .001 level for all time periods but 1930, therefore we can state with 99.9 per cent assurance that the type of vegetation cover was associated with farm location choice.

2) The association, though consistently at the .001 level for all but the one time period, nonetheless tended to become less significant through time. This is largely due to the decreasing amount of choice available to the farmer in later periods and to the associated rising importance of other variables in location choice.

3) In general, the greater the proportion of grassland on a unit of land, the more favorably it was viewed in location preference. This preference was consistent through time and moved from open grassland through the various categories to forest land in a sequential manner through time.

4) Distinctions between grassland and scrub or forest tended to be more persistent, and hence more important, than distinctions between the various categories containing significant amounts of grassland.

5) The fact that not all grassland was chosen before groveland began to be chosen and so on indicates that location factors other than vegetation were operative throughout the time span.

CHAPTER IV

LAND ENTRY AND DISTANCE TO A MAJOR TRANSPORTATION ROUTE

A. Material

The second variable to be considered in the study of the process of agricultural settlement is the distance a unit of land lay from the nearest major transportation route. Two problems must be discussed before proceeding to the analysis of this variable: what constitutes a "major" transportation route; and, how are the distances to be measured.

In considering the first problem, it is clear that the characteristics of the route itself cannot be used consistently through the entire time span to define a "major" route. Technological advances have rapidly changed the evaluation of what is a "major" route from one generation to the next and often even more rapidly. The characteristics of the wagon road which served as a major transportation route in the early part of the time span could hardly be applied as criteria for the determination of major transportation routes in the twenties much less for the present time. The evaluation of such routes must take place within the historical and technological frames of reference in which the routes were set. Since these routes must be located fairly precisely, contemporary maps for each time period were used as sources of information (see Appendix F). These maps indicate the relative importance of existing routes, either by symbolization or merely by the inclusion or exclusion of certain routes. Som further refinements in the selection of routes was added by

imposing other requirements: the route must have functioned as an all-year route over which products and supplies were reliably moved by the means of transportation commonly in use in that time period. These restrictions do not insure the complete objectivity of evaluation of major transportation routes, but it is felt that a reasonable consistency in evaluation can be assumed under these conditions.

The second problem arises from the fact that the distance between a quarter-section and a major transportation route can be measured in various ways. For this study, the choice was between measurement of straight-line distance or road distance. The straight-line measurement has the advantage of being straightforward in method and may be consistently applied through the entire time period for all pieces of land. Straight-line distance tends to approximate the actual distance to be travelled in the earlier periods, while in later periods the straight-line distance may have been somewhat shorter than the actual distance to be travelled. In the early periods travel across the open grasslands in a reasonably direct route was often possible. In the later periods extension of settlement onto the more heavily treed areas made such travel impossible. For these reasons the main disadvantage of straight-line measurement of distance is that lands in the same distance category might be evaluated differently by settlers of two separate time periods. The one may be assessing the critical distance in general straight-line terms while the other is assessing it by reference to the distance to be travelled by road.

The measurement of actual road distances between the unit of land and the nearest major transportation route solves this problem but raises others. First it assumes that all the secondary access roads are known and can be located fairly precisely. There are insufficient transportation data for the location of these secondary roads, especially in the earlier time periods. Secondly, the measurement of all land entered upon in all time periods by such a method is beyond the time resources of this study. Thirdly, distances cannot be calculated for land beyond the major road and rail network since access roads do not exist. One would be forced to measure at least part of the distance by a straight-line method, so consistency of measurement would be lacking. For these reasons it was felt that straight-line measurement of distances would be advantageous in this study. Consistency of measurement for all pieces of land throughout the time span can be maintained. Computer measurement can be utilized thus ensuring speed and accuracy.[1]

Once this decision had been made, distances were measured from the center of each quarter-section to the nearest point on a major road, and to the nearest station or point of access on a railway. The units of land were then calssified according to the distance from the nearest route, whether road or rail, as follows: 1) 0-2 miles; 2) 3-4 miles; 3) 5-6 miles; 4) 7-8 miles; 5) 9-10 miles; 6) 11-15 miles; 7) 16-20 miles and 8) over 20 miles. The transportation network existing at each time period, with the additions to, and deletions from the previous network, was used as the base for this measurement (see Appendix E).

---

[1] Sitwell, O.F.G., Land Use and Settlement Patterns in Picton County, Nova Scotia, Unpublished Ph.D. Dissertation, Un. of Toronto, 1968, pp. 97, 98.

TABLE 4.1

Land Available According to Distance From Nearest Transportation Route
(in quarter-sections)

Time Period		Distance Category								
		1	2	3	4	5	6	7	8	Total*
1	(1908-10)	545	431	461	467	527	1274	836	652	5193
2	(1911)	1194	902	679	459	314	555	537	587	5227
3	(1912)	851	712	701	582	443	796	619	764	5468
4	(1913)	701	617	655	643	530	822	693	767	5428
5	(1914)	603	531	606	613	508	781	786	1468	5896
6	(1915)	535	464	567	571	490	721	758	1454	5560
7	(1916)	499	444	589	577	441	688	706	1401	5345
8	(1917)	442	409	557	585	496	729	651	1332	5201
9	(1918)	399	377	532	542	466	647	528	1233	4724
10	(1919)	376	335	441	511	462	606	458	1139	4328
11	(1920-27)	317	303	387	455	406	561	398	1683	4510
12	(1928)	1077	1063	986	490	190	195	0	0	4001
13	(1929)	804	1008	860	333	148	25	0	0	3178
14	(1930)	633	800	723	341	146	25	0	0	2668
15	(1931-38)	535	636	601	306	135	25	0	0	2238
16	(1939-45)	464	571	524	281	134	24	0	0	1998
17	(1946-56)	444	541	493	268	175	55	0	0	1976
18	(1957-68)	383	406	273	94	73	12	0	0	1241

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

*Totals differ from those of Table 3.3 as some land in vegetation category 9 was available for settlement (i.e. land surveyed but with 75 per cent or more of the transect as water).

TABLE 4.2

Entries According to Distance Category (in quarter-sections)

Time Period		Distance Category								
		1	2	3	4	5	6	7	8	Total*
1	(1908-10)	70	57	36	68	77	63	2	0	373
2	(1911)	379	275	120	16	5	65	42	0	902
3	(1912)	150	125	105	24	3	39	20	5	471
4	(1913)	98	86	49	30	22	43	36	3	367
5	(1914)	68	67	39	42	18	60	28	14	336
6	(1915)	59	47	39	52	15	54	52	53	371
7	(1916)	37	35	36	30	17	98	110	69	452
8	(1917)	43	32	25	43	30	82	123	99	477
9	(1918)	23	42	91	31	4	41	70	106	408
10	(1919)	33	27	39	59	57	47	60	144	466
11	(1920-27)	27	33	42	50	60	65	55	176	508
12	(1928)	375	254	122	32	23	17	0	0	823
13	(1929)	171	208	137	12	2	0	0	0	530
14	(1930)	98	164	122	35	11	0	0	0	430
15	(1931-38)	66	65	77	25	1	1	0	0	235
16	(1939-45)	8	1	1	2	0	0	0	0	12
17	(1946-56)	93	42	23	6	0	0	0	0	164
18	(1957-68)	91	39	12	12	4	0	0	0	158

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

*Totals differ from those of Table 3.1 as several quarters of land that were entered before survey are not considered on this table.

Measurement and classification of distances for each unit of land available (i.e. surveyed, not restricted and not previously entered) was computed and the results are given in Table 4.1. The results of similar computations for the land units entered upon in each time period are given in Table 4.2. Time period 15 (1931-68) of the previous chapter has been subdivided into four time periods. Such a division was necessary as the changes in the transportation network invalidated the use of one network as the basis for distance measurement for the time period of that length.

B. Analysis

The analysis of association between the farmers' choice of location and the distance to the nearest major transportation route again utilizes the chi-square test. The null hypothesis is: the farmers' choice of location was not significantly associated with the distance of the land unit from the nearest major transportation route. Under the null hypothesis the frequency with which he chose land at certain distances was determined by chance i.e. in proportion to the amount of land available in each distance category.

In a hypothetical study area where the distance to the nearest major transportation route is a significant determinant of farm location, certain patterns of choice through time may be postulated. At the beginning of settlement one would expect that preference for land close to the available transportation routes would result in farmers occupying this "better" land with much greater frequency than would be expected by chance. Conversely, one would expect that the

frequency with which farmers chose lands more distant from these routes would be much lower than expected by chance. If a chi-square test were applied to these conditions the high positive values plus the high negative values would result in a large chi-square value. This would indicate a high probability of an association between distance factors and choice of location.

As the land closest to the transportation routes was occupied settlement would be forced onto land increasingly more distant. As the farmers' range of choice narrowed insofar as transportation was concerned, it may be hypothesized that they would become increasingly indifferent to differences in distance and would become more concerned with other locational variables. If this was the case then it would be reasonable to expect that increasingly, farmers would choose land in proportion to the amount that was available in each distance category. If the chi-square test were applied through time then, it would be found to yield declining values through time. In general terms, the hypothetical case just stated is similar to the hypothetical case in terms of vegetation; chi-square values will tend to be large in the initial time periods and will decline in a rather even manner through time.

Again, several factors will tend to disrupt this general pattern of chi-square values:

a) Variations in the number of entries in each time period will result in variations of the chi-square value if all other conditions are equal (see p. 33).

b) A change in distance preference will result in a disruption of the pattern described. In such a situation, farmers would tend to choose previously undesirable land at unexpected rate, which would lead to high chi-square values.

c) Technological advances in transportation could result in a lessening of the influence of distance on farm location. In such a case, one would expect that discrimination between distance categories would break down and other locational variables would take precedence. A chi-square test applied to this situation would yield much lower values than would be expected otherwise.

d) If only part of the total area was available in the initial time period, subsequent release of other lands to settlement (especially if the land was near a major transportation route) would tend to increase the chi-square value in those time periods when the land was released (see p. 32).

e) The rate of decline of the chi-square values through time, would be affected by the rate at which the transportation network expanded in the area. The amount of available land in the extreme distance categories (over fifteen miles) would decrease as the transportation network expanded. This would narrow the farmers' range of choice and one would expect that they might become increasingly indifferent to distance which would result in low chi-square values. On the other hand, this same expansion would result in an increase in the amount of land available in the most favorable distance categories. Choice of location is likely then to be abnormally high in these categories which

would tend to increase the chi-square values. In general then, chi-square values are likely to increase in periods of rapid road and rail extension but this increase will be partially offset by the narrowing range of choice available to the farmer.

Table 4.3 sets out the category and chi-square values computed from the real study area. The chi-square values indicate that the null hypothesis can be rejected at the .02 level in 1919 and in 1931-1938, and at the .001 level for all other time periods except 1920-1927 when the null hypothesis must be retained. Thus there are only two chances in one hundred that the association between location choice and the distance to the nearest major transportation route in 1919 and 1930-1938 is a result of chance. In all other cases but 1920-1927, there is only one chance in one thousand that such an association exists by chance.

A cursory consideration of Table 4.3, however, leads to the conclusion that there appear to be more discrepancies than similarities in the general pattern of chi-square values in the real and hypothetical study areas. Two reasons for these discrepancies may be put forward: either they result from one or more of the disruptive factors mentioned in the hypothetical case, or they result from the fact that the real situation is significantly different from the hypothetical situation.

Some very general explanations may be put forward regarding the general pattern of the chi-square values. The high positive anomalies of 1911 and 1928 may have been the result of the relatively large number of entries during these periods (907 and 823 respectively). Large

TABLE 4.3

Category and Chi-square Values - Land Entry and Distance to Nearest Major Transportation Route*

Time Period		Distance Category								
		1	2	3	4	5	6	7	8	Chi-square
1	(1908-10)	+24.6	+19.5	+0.1	+34.0	+43.2	-8.6	-56.1	-47.0	233.1
2	(1911)	+142.9	+102.1	+0.1	-52.2	-44.5	-9.5	-29.6	-99.0	479.9
3	(1912)	+81.2	+67.1	+31.7	-12.8	-32.2	-12.4	-21.4	-56.4	315.2
4	(1913)	+52.1	+46.1	+0.6	-4.4	-6.1	-2.6	-3.0	-45.2	160.1
5	(1914)	+34.0	+45.6	+0.4	+1.4	-4.2	-5.8	-16.2	-58.3	165.9
6	(1915)	+16.4	+7.0	+0.1	+4.3	-9.8	+0.8	+0.1	-19.3	57.8
7	(1916)	+4.6	-0.2	-3.9	-8.0	-10.0	+25.8	+44.1	-20.3	116.9
8	(1917)	+0.1	-1.1	-12.5	-1.6	-5.0	+9.3	+66.2	-4.3	100.1
9	(1918)	-4.1	+2.4	+41.2	-5.4	-33.4	-3.6	+13.9	0.0	104.0
10	(1919)	-1.2	-1.8	-1.4	+0.2	-1.3	-5.0	-2.5	+3.6	17.0
11	(1920-27)	+2.2	0.0	0.0	0.0	+4.3	0.0	+1.8	-1.2	9.5
12	(1928)	+105.4	+6.0	-31.7	-45.1	-7.1	-13.2	ND	ND	208.5
13	(1929)	+9.6	+10.1	-0.2	-34.6	-20.2	-5.0	ND	ND	79.7
14	(1930)	-0.1	+9.5	+0.3	-7.9	-7.0	-4.0	ND	ND	28.8
15	(1931-38)	+2.2	-0.1	+3.1	-1.5	-12.1	-0.5	ND	ND	19.5
16	(1939-45)	Insufficient Data for chi-square computation								
17	(1946-56)	+84.8	-0.2	-7.9	-11.6	-15.0	-5.0	ND	ND	124.5
18	(1957-68)	+36.0	-2.8	-15.1	0.0	-2.8	-2.0	ND	ND	58.7

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

ID - Insufficient data for chi-square computation

*Since category values involve squaring the difference between the observed and expected frequencies, sign values are always positive. The use of positive and negative signs in the table only indicate the direction of the departure from the expected frequency i.e. whether the value results from more land (+) or less land (-) than expected being chosen in a particular category.

values up to 1914 could be attributed to factor (d) above since land was being released to settlement by the survey during these years. Even these do not explain all of the anomalies, and a consideration of the category values reveals how little pattern there appears to be in the association of distance and location choice. Most important is that there is very little evidence of consistent evaluation of distances in terms of preference. If one assumes, as in the hypothetical case, that land became less preferred as its distance from a transportation route increased, the table reasonably substantiates this only up to 1915. After this date the preference for land according to distance category appears distinctly haphazard, although some pattern emerges again after 1928.

In addition to the abnormally large number of entries in 1928, the release of certain school lands, many units of which occurred in the lowest distance categories, no doubt added to the high chi-square value of that time period. The high values of 1916, 1917 and 1918 are primarily due to large positive category values for lands in the 7-8 and 9-10 mile categories. This might point to the fact that, since the railway was extended to Grande Prairie in 1916, even land 10 miles away became viable to the extent that other locational considerations took precedence. It might be argued that the high positive category values for the 0-2 mile class in time periods 17 (1946-56) and 18 (1957-68) were due to the extension of the transportation network to include almost all parts of the area, thus bringing much land into the lowest distance categories. A complementary point is that near the end of the settlement

period lands were so marginal in point of other locational considerations that the distance to transportation had to be very low in order to make them viable at all.

The underlying reason for much of the variation noted in the pattern of category and chi-square values then, is suggested to occur as the result of disruptive factor (b) above. Either the distances themselves were being perceived differently through time i.e. at some point in time for some reason or other it was seen to be more beneficial to be located 10 miles from transportation than 3 miles away, or the operation of some other locational factor makes it appear that the farmer changed his distance preferences. It seems much more likely that the latter explanation is correct although at this point the analysis is incomplete. If this explanation is correct, we must conclude that, while the chi-square test has revealed an association between location choice and distance from the nearest major transportation route that is extremely unlikely to occur by chance in most time periods, the test has indicated very little as to the character of this association.

One general comment should be made before undertaking a consideration of the relationship between various distance categories. With the exception of the time span between 1916 and 1928, broad preference for lands nearer transportation routes is generally greater than lands at some distance from these routes. In the period 1908 to 1915 the critical distance between choice and avoidance seems to be between 7 and 10 miles. In the period from 1928 to 1968 the critical distance seems to be between 3 and 6 miles. Land more than 20 miles from a

major transportation route was generally avoided (as indicated by the negative values) in all time periods but 1919 and even here the positive departure is quite small.

Specific Analysis

The results of two other applications of the chi-square test are given in Tables 4.4 and 4.5. Their purpose is to give some insight into the farmers' evaluation of the distance as classified in this study, i.e. whether the farmer discriminated between certain categories, and whether there was some consistency in this evaluation through time. Table 4.4 gives the results of applying the chi-square test on pairs of distance categories. Table 4.5 sets out the chi-square values for pairs of consolidated distance categories. As in the pervious chapter, the notations of significant and insignificant values indicates whether the farmer was choosing one category of land at a much higher rate and one at a lower rate than that expected by chance, and thus whether he is, in fact, discriminating between the two categories. Although the results do not lead to a clear identification of patterns of association, some general statements about the farmers' evaluation of distances may be made from a consideration of these tables.

Table 4.4 - Analysis

1) In most time periods, farmers tended to ignore the distance difference between lands up to 2 miles from a transportation route and those 3-4 miles distant. In twelve of the seventeen time periods, the distribution of choice between these two distance categories could have

been produced by chance. The high probability of discrimination in the last two time periods may be explained by the fact that, by this time available land was so marginal in many physical respects, it became increasingly important that the land be located as near a route as possible to be viable at all. The extension of the transportation network would have brought much land into the lower distance categories and this could have encouraged a more careful evaluation of the distances involved.

2) Discrimination between the differences in consecutive pairs of distance categories from category 2 (3-4 miles) to category 5 (9-10 miles) is not evident in half the time periods involved. In 1916, 1917, 1919 and 1920-27, no discrimination is apparent in distances up to 10 miles in terms of choice preference.

3) Farmers tended to ignore differences between categories 6 (11-15 miles) and 7 (16-20 miles) in over half the time periods but discriminated quite consistently between categories 5 (9-10 miles) and 6 (11-15 miles) and between categories 7 (16-20 miles) and 8 (over 20 miles). This would seem to suggest that farmers tended to avoid land over 20 miles from transportation and preferred land under 11 miles distant, but between these two extremes exhibited little preference. In the period 1914-1918 the significant values arise from positive choices in the most distant category (note the asterisks) which weakens the above generalization, however this seems to be an exceptional time period (see p. 55).

TABLE 4.4

Chi-square Values for Paired Distance Categories - Land Entry and Distance to Nearest Major Transportation Route

Time Period	Distance Category Pairs						
	1&2	2&3	3&4	4&5	5&6	6&7	7&8
1 (1908-10)	0.0 (NS)	6.2 (.02)	8.6* (.01)	0.0 (NS)	44.7 (.001)	37.0 (.001)	ID
2 (1911)	0.2 (NS)	25.8 (.001)	73.2 (.001)	3.1 (NS)	24.9* (.001)	3.7 (NS)	46.2 (.001)
3 (1912)	0.0 (NS)	1.4 (NS)	38.3 (.001)	12.2 (.001)	14.9* (.001)	2.5 (NS)	13.2 (.001)
4 (1913)	0.0 (NS)	13.1 (.001)	4.1 (NS)	0.0 (NS)	0.6 (NS)	0.0 (NS)	29.6 (.001)
5 (1914)	0.5 (NS)	12.3 (.001)	0.0 (NS)	5.4 (.02)	9.0* (.01)	11.6 (.001)	17.5 (.001)
6 (1915)	0.2 (NS)	3.0 (NS)	2.2 (NS)	15.3 (.001)	10.1* (.01)	0.4 (NS)	10.8 (.001)
7 (1916)	2.8 (NS)	0.9 (NS)	0.6 (NS)	0.7 (NS)	28.6* (.001)	0.4 (NS)	64.6 (.001)
8 (1917)	0.8 (NS)	4.6 (.05)	3.7 (NS)	0.9 (NS)	8.4* (.01)	14.3* (.001)	73.5 (.001)
9 (1918)	6.1* (.02)	5.3* (.05)	31.5 (.001)	16.6 (.001)	20.4* (.001)	14.6* (.001)	7.7 (.01)
10 (1919)	0.0 (NS)	0.0 (NS)	2.0 (NS)	0.2 (NS)	5.6 (.02)	7.5* (.01)	0.1 (NS)
11 (1920-27)	1.1 (NS)	0.0 (NS)	0.0 (NS)	2.3 (NS)	1.6 (NS)	0.9 (NS)	3.4 (NS)
12 (1928)	20.6 (.001)	35.9 (.001)	10.6 (.01)	5.9* (.02)	0.8 (NS)	ID	ND
13 (1929)	0.0 (NS)	5.6 (.02)	29.8 (.001)	1.4 (NS)	ID	ID	ND
14 (1930)	4.5* (.05)	2.7 (NS)	6.6 (.01)	0.9 (NS)	ID	ID	ND
15 (1931-38)	1.1 (NS)	1.8 (NS)	3.6 (NS)	8.8 (.01)	ID	ID	ND
16 (1939-45)	Insufficient Data						
17 (1946-56)	30.6 (.001)	4.0 (.05)	2.3 (NS)	ID	ID	ID	ND
18 (1957-68)	24.1 (.001)	5.3 (.05)	8.0* (.01)	2.3 (NS)	ID	ID	ND

NS - not significant (probability greater than .05)
ID - insufficient data for calculation of chi-square
ND - no land available in these categories
*significance due to positive choice of more distant land

4) Very little discrimination between any distance categories (as paired) is evident in time periods 7 (1916), 10 (1919), 11 (1920-27) and 15 (1931-38). It is possible that the coming of the railway in 1916 lessened the importance of distance as a locational factor (see above); 1917 also shows a relatively high disregard for distance discrimination. Even though the values for pairs 5 and 6 and pairs 6 and 7 are significant, the positive choice is in the direction of the most distant land in each case. The influx of a large number of soldiers in the post-war years may have contributed to a more haphazard settlement with a consequent disregard for distance considerations. A similar situation in the depression years (1931-38) could have resulted from the influx of disenchanted settlers from the southern sections of the Prairie Provinces.

5) With some exceptions the values for the years before 1914 and after 1919 show a consistent preference for lands nearer to, rather than farther from a transportation route in the pairs of distance categories. The values between 1914 and 1919 in many cases show no such preference (i.e. the values are not significant) and in several of the significant values, particularly in pairs 5 and 6 and pairs 6 and 7, they indicate preference for the more distant land. This period (1914-1919) seems to have been particularly lacking in any pattern of association between distance and location choice perhaps due to the fact that other locational factors were assuming primary importance.

Table 4.5 - Analysis

This table attempts to evaluate farmers' discrimination between distance categories in more general terms. The previous distance categories have been consolidated as follows: categories 1-3 (0-6 miles); categories 4-5 (7-10 miles); and categories 6-8 (over 10 miles). These are then tested in pairs, and the chi-square values and level of significance are given as in Table 4.4. The paired categories are changed slightly in time period 13 (1929) because of the disappearance of lands over 15 miles from transportation routes. The general comments that may be made tend to substantiate the comments made previously.

1) Discrimination is made most clearly and most consistently between lands 0-6 miles and 7-10 miles from a transportation route. There appears to be no significant discrimination between these categories in time periods 8 (1917) and 18 (1957-68). The most interesting exceptions are found in time periods 1 (1908-10), and 10 (1919) where the farmers tended to discriminate in favor of the more distant lands. In the 1908-10 period it may be postulated that the preference for grassland identified in the previous chapter took precedence over distance considerations and that the farmer chose grassland without regard for its distance from a transportation route. It is possible that other locational factors were dominant in the second time period mentioned although speculation on their relationships is not possible at this point.

2) Discrimination between lands 6-10 miles and over 11 miles distant from transportation either does not exist or lacks consistency

TABLE 4.5

Chi-square Values for Consolidated Distance Pairs - Land Entry and Distance to Nearest Major Transportation Route

Time Period	Distance Category Pairs	
	1-3 and 4-5	4-5 and 6-8
1 (1908-10)	4.9* (.05)	192.8 (.001)
2 (1911)	173.7 (.001)	13.1* (.001)
3 (1912)	112.7 (.001)	0.2 (NS)
4 (1913)	45.3 (.001)	0.4 (NS)
5 (1914)	17.3 (.001)	8.0 (.01)
6 (1915)	7.1 (.01)	1.1 (NS)
7 (1916)	12.6 (.001)	24.1* (.001)
8 (1917)	0.0 (NS)	15.1* (.001)
9 (1918)	49.1 (.001)	29.1* (.001)
10 (1919)	5.4* (.02)	0.2 (NS)
11 (1920-27)	2.8 (NS)	1.6 (NS)
12 (1928)	68.2 (.001)	0.1 (NS)

	1-3 and 4-8
13 (1929)	64.1 (.001)
14 (1930)	19.5 (.001)
15 (1931-38)	12.5 (.001)
16 (1939-45)	Insufficient Data
17 (1946-56)	39.9 (.001)
18 (1957-68)	2.5 (NS)

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

NS - not significant (probability greater than .05)
*significance due to positive choice of more distant land

in most of the time periods up to 1928. In six time periods there is no evidence to indicate discrimination between the categories involved and in four of the remaining six periods, the discrimination evidenced was in favor of the more distant lands.

In general then, one may say that farmers tended to choose land 6 miles or less from a transportation route over that land which was located over 6 miles away. On land located more than 6 miles distant the pattern of choice becomes rather unpredictable and seems in most cases not to be associated with distance.

Summary

The purpose of this chapter was to analyze the association between farmers' choice of farm location and the distance of the land from the nearest major transportation route. Distances for each unit of land available and each unit of land entered upon for each time period were calculated by the computer utilizing the transportation network in existence in the time period under consideration. These units of land were classified according to distance in the following categories: a) 0-2 miles; b) 3-4 miles); c) 5-6 miles; d) 7-8 miles; e) 9-10 miles; f) 11-15 miles; g) 16-20 miles; and h) over 20 miles. Observed frequencies and expected frequencies were calculated for each category in each time period and the chi-square test applied to each time period (Table 4.3) and then to pairs of distance categories in each time period (Tables 4.4 and 4.5). The major findings of the analysis may be summarized as follows:

1) Although the chi-square values indicate a significant association between settlement and distance from a major transportation route in all but one time period, the vagaries of choice indicated by the category values and the paired chi-square values lead to the conclusion that, while the distribution of choice cannot be attributed to chance, the significance of the association is probably due to a different and more important locational factor than distance to transportation in many of the time periods. The assumption that farmers consistently chose land nearer a transportation route over land more distantly located which was the basis of the hypothetical case therefore cannot be applied to the real situation.

2) The time span between 1914 and 1919 is especially lacking in any consistent evaluation of distance as a positive or negative influence on farm location. In many cases the significance of the discrimination between pairs of categories is a result of abnormal positive choice of lands in the more distant category.

3) Before 1914 and after 1919 there appears to be a more consistent evaluation of nearer lands as "favorable" and farther lands as "unfavorable". Between 1908 and 1914 the boundary between favorable and unfavorable lands appears to have been between 7 and 10 miles. After 1919 it appears to have been between 3 and 6 miles.

4) Farmers tended to exhibit little preference between lands under 2 miles and lands 3-4 miles from a transportation route in most time periods. The high discrimination in the last two time periods might suggest that distance considerations became increasingly

important as settlement was being forced onto physically marginal lands.

5) The most consistent discrimination between distance categories is between categories 7 (16-20 miles) and 8 (over 20 miles), all time periods but two of which indicate a significant positive preference for lands in the nearer category.

6) In general farmers tended to choose lands under 7 miles from transportation rather than lands 7-10 miles distant, whereas there seems to be little consistent preference for the nearest lands when choosing between land 7-10 miles and land over 10 miles distant.

7) Discrimination between consecutive pairs of distance categories appears to have been minimal in time periods 7 (1916), 10 (1919) and 11 (1920-27).

POST OFFICES

Number	Name	Years of Operation*
1	Demmitt	1929-1968
2	Brainard	1919-1961
3	Lymburn	1932-1968
4	Hythe (1)	1914-1928
5	Hythe (2)	1929-1968
6	Goodfare	1919-1968
7	Clearview	1920-1929
8	Hommy-Albright	1929-1955
9	Redlow-Beaverlodge (1)	1910-1927
10	Beaverlodge (2)	1928-1968
11	Windsor Creek	1929-1942
12	Mount Valley	1938-1951
13	Rio Grande	1919-1957
14	Hazelmere	1930-1964
15	Sylvester	1936-1951
16	Elmworth	1920-1968
17	Leighmore	1922-1947
18	Hinton Trail (1)	1923-1945
19	Hinton Trail (2)	1946-1968**
20	Halcourt (1)	1913-1923
21	Halcourt (2)	1924-1962
22	Huallen	1929-1968
23	Wembley	1924-1968
24	Pipestone Creek	1933-1963
25	Beaverlodge-Lake Saskatoon	1909-1927
26	Hermit Lake	1915-1919
27	Dimsdale	1927-1967
28	Bredin	1915-1930
29	Clairmont	1916-1968
30	Grande Prairie	1911-1968
31	Kleskun Hill	1913-1940
32	Glen Leslie	1914-1956
33	Bezanson	1915-1968
34	Fitzsimmons	1933-1951
35	Teepee Creek	1924-1968
36	Smoky Heights	1932-1958
37	Bad Heart	1929-1968**
38	Sexsmith (1)	1912-1915
39	Sexsmith (2)	1916-1968
40	Webster	1929-1966
41	Spitfire Lake-Buffalo Lake	1915-1921
42	Buffalo Lake	1922-1968
43	Niobe (1)	1915-1921
44	Niobe (2)	1922-1932
45	La Glace	1917-1968
46	Poplar Hill	1930-1944
47	Valhalla Centre	1923-1968
48	Valhalla	1916-1968
49	Homestead	1930-1962

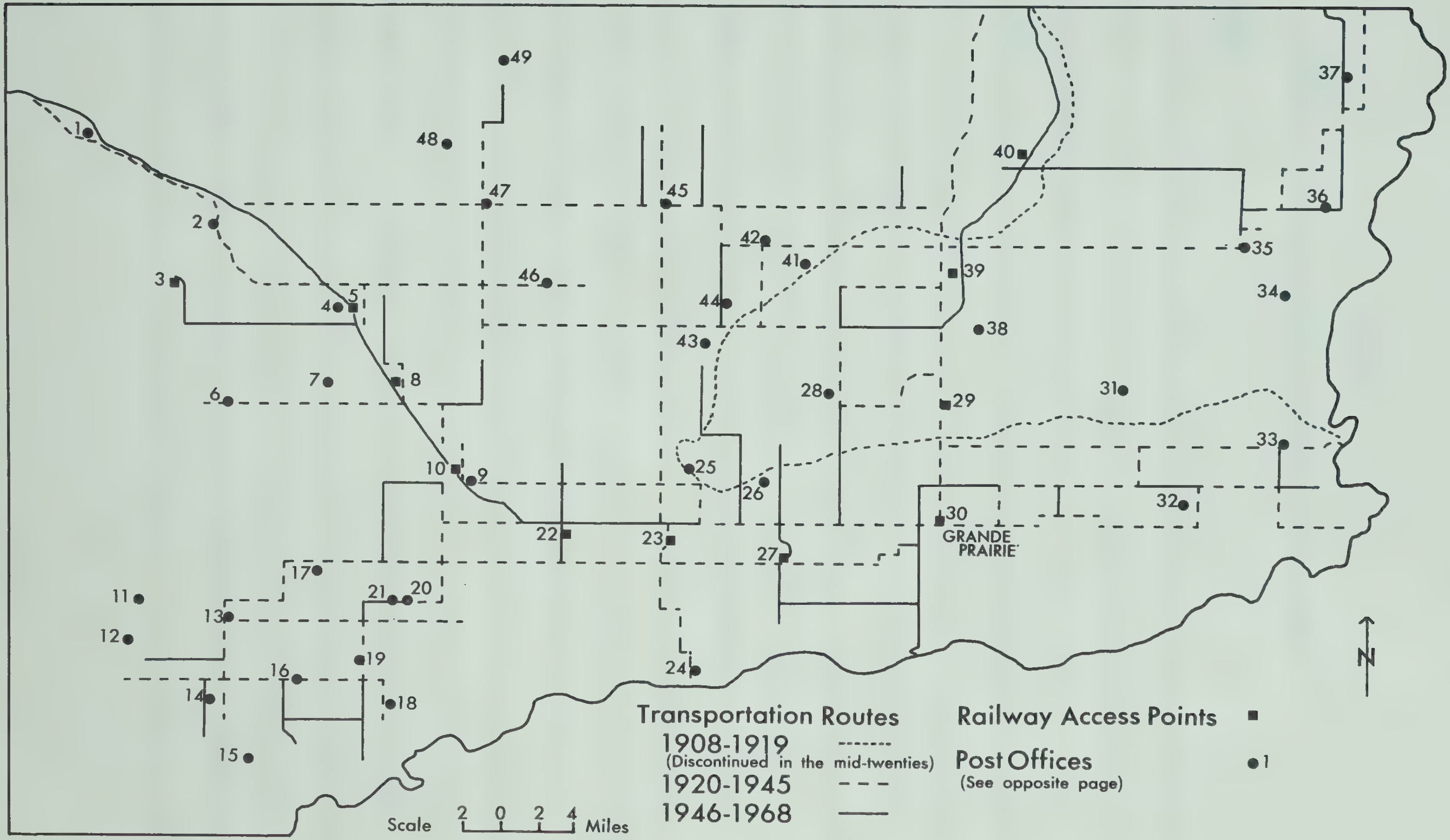
*Except where noted a final date of 1968 indicates office is currently in operation (December, 1968).

**Post Office closed in 1968.

Source: Canada Post Office, Ottawa.

Figure 4

MAJOR TRANSPORTATION ROUTES AND POST OFFICES



CHAPTER V

LAND ENTRY AND DISTANCE TO NEAREST SETTLEMENT

A. Material

The last of the basic locational determinants to be evaluated is the distance to the nearest settlement. Again, two problems must be resolved before an evaluation can be begun. The first is the problem of defining a settlement. Smallness of size was not considered a limitation on what was felt to be the main functions of the settlement in this study, namely to serve as a focus for social interaction and to provide some fundamental service to the local community. What was needed then was the smallest community component that either in itself filled these requirements or functioned together with other components so as to provide these services. From several components that would seem to be useful (church, post office, school, hall, store) the post office was chosen as the basic requirement for defining a settlement. The post office serves both social and service functions and also occurs regularly with other community components that serve these ends as well. It might be argued that stores would be equally useful in this regard, however the locations and duration of operation of the post office can be determined with much greater accuracy than can be done in the case of stores. As the time span under consideration is fairly lengthy, and many changes have occurred in the locations of

both stores and post offices[1] accuracy was felt to be an overriding consideration.

The second problem, that of measuring the distances involved, has been discussed in the previous chapter. The points raised there are applicable equally to the present discussion, hence straight-line distances are utilized.

Having made these decisions, each of the forty-nine post office locations was plotted and the length of operation recorded, utilizing lists supplied by the Canada Post Office, Ottawa. Distances to the nearest post office for each quarter-section of land entered upon and for each quarter-section available (surveyed but not occupied and not restricted) in each time period were calculated by computer. All land available in each time period was classed according to its distance from the nearest settlement as follows: 1) 0-2 miles; 2) 3-4 miles; 3) 5-6 miles; 4) 7-8 miles; 5) 9-10 miles; 6) 11-15 miles; 7) 16-20 miles and 8) over 20 miles. The results are given in Table 5.1. Table 5.2 gives the results of similar computations for all quarter-sections entered upon in each time period.

B. Analysis

The chi-square test is used to test the association between the farmers' choice of location and the distance to the nearest settlement

---

[1] Forty-one post offices in forty-nine separate locations have served the study area in the time span 1908 to 1968, only nineteen of which are in operation presently (see Figure 3).

TABLE 5.1

Land Available According to Distance from Settlement (in quarter-sections)

Time Period		Distance Category								
		1	2	3	4	5	6	7	8	Total
1	(1908-10)	141	351	492	558	626	1278	633	1114	5193
2	(1911)	101	421	612	655	677	1312	761	688	5227
3	(1912)	103	388	569	592	673	1673	1128	342	5468
4	(1913)	149	535	785	852	751	1188	858	310	5428
5	(1914)	179	680	1005	990	897	1545	561	39	5896
6	(1915)	231	677	1044	1031	882	1443	250	2	5560
7	(1916)	257	761	1192	1052	761	1075	235	12	5345
8	(1917)	178	675	1163	989	724	1086	334	52	5201
9	(1918)	131	541	1000	933	685	1048	334	52	4724
10	(1919)	182	708	1156	828	542	591	271	50	4328
11	(1920-27)	217	817	1246	1041	638	551	0	0	4510
12	(1928)	179	626	1080	964	619	533	0	0	4001
13	(1929)	301	777	1007	721	303	69	0	0	3178
14	(1930)	247	705	832	566	253	65	0	0	2668
15	(1931-38)	229	611	666	489	202	41	0	0	2238
16	(1939-45)	201	518	604	441	197	37	0	0	1998
17	(1946-56)	96	348	532	535	353	112	0	0	1976
18	(1957-68)	54	252	361	286	209	79	0	0	1241

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

TABLE 5.2

Land Entered Upon According to Distance to Settlement
(in quarter-sections)

Time Period		Distance Category								
		1	2	3	4	5	6	7	8	Total
1	(1908-1910)	77	66	61	51	19	76	22	1	373
2	(1911)	28	132	170	173	155	227	14	3	902
3	(1912)	28	79	86	66	53	116	36	7	471
4	(1913)	38	79	98	50	23	58	21	0	367
5	(1914)	27	91	75	55	30	41	17	0	336
6	(1915)	44	70	83	62	72	40	0	0	371
7	(1916)	94	130	116	55	38	19	0	0	452
8	(1917)	47	134	160	61	39	36	0	0	477
9	(1918)	23	109	132	82	24	38	0	0	408
10	(1919)	30	140	140	68	35	42	11	0	466
11	(1920-27)	37	183	188	67	15	18	0	0	508
12	(1928)	61	254	298	151	28	31	0	0	823
13	(1929)	77	133	174	123	19	4	0	0	530
14	(1930)	55	131	132	64	41	7	0	0	430
15	(1931-38)	35	89	67	41	3	0	0	0	235
16	(1939-45)	2	5	4	1	0	0	0	0	12
17	(1946-56)	39	66	46	12	1	0	0	0	164
18	(1957-68)	27	50	37	27	16	1	0	0	158

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

as indicated by a post office. The null hypothesis is: farmers' choice of location was not significantly associated with the distance of the quarter-section from the nearest settlement. Therefore, under the null hypothesis, the frequency with which farmers chose land at certain distances (i.e. in certain distance categories) was determined by chance, or occurred in proportion to the amount of land available in each distance category.

In a hypothetical study area where the distance to the nearest settlement is a prime determinant of location choice, a pattern of choice similar to the previous example (distance to nearest transportation route) would be expected. In the early periods, abnormal positive choice of land near settlement coupled with abnormal avoidance of distant lands would produce high chi-square values. As land close to settlements became occupied, choice would be restricted to more distant land and we might expect that as the range of choice narrowed, the farmer would choose land in proportion to its availability. Chi-square tests applied to these time periods would yield low values, if this proved to be the case. In general, then, we would expect that chi-square values would begin fairly high in the early time periods and decline somewhat evenly to the end of the time span.

This hypothetical pattern of choice and chi-square values will be interrupted in ways similar to those described in the previous chapter: the release of land to settlement by the survey, change in distance perception, discrepancies in the number of entries in the time

periods, and the interference of other locational factors. In addition two other factors will disrupt the chi-square pattern of the present hypothetical situation.

Post offices, unlike transportation routes, never pre-dated settlement in a particular locality. The establishment of a post office was dependent on a concentration of settlers in a locality. The basic service that the post office provided required an established local population though it also may have contributed to its expansion. As a consequence, it is reasonable to assume that, if the post office was established near the center of an established community, any influence it might have on farm location would occur primarily in the middle distance categories, the land closer in having been occupied previously. If land in the closer categories still was unoccupied it would be reasonable to propose that such land must have had fairly serious locational disadvantages of some other sort. This fact would curtail to some degree the rush to this land one would expect if a post office were established in the area. In the light of this, it is possible that the chi-square values would be somewhat lower than would be expected under conditions where a fair representation of all sorts of land in each distance category was available.

A second difference between transportation routes and post offices is that the latter tended to be less permanent. There were not only periodic increases in the number of post office locations, but, particularly in the most recent time periods, there also were significant decreases in their numbers. The latter situation could have the effect

of emphasizing the choice of lands in the most distant categories. The decline in the number of post offices would increase the distance between most of the available land and the nearest settlement. If available land was not occupied when a post office was rather near, it is unlikely that such land would be settled when the number of post offices declined if distance were a major factor. Any expansion would be confined primarily to the periphery of the settled area, and thus positive abnormalities in choice could be expected in the most distant categories. This situation would not occur if the post offices discontinued were in closely settled areas however.

Table 5.3 sets out the category and chi-square values in each time period for the study area. The value for time period 14 (1930) is significant at the .05 level and all others are significant at the .001 level. The null hypothesis therefore can be rejected with confidence. An association between distance to settlement and land entry such as this would be dependent on chance only once in a thousand times.

Although the category values indicated that land closer to settlements was consistently preferred over more distant land (the basic assumption in the hypothetical case), the pattern of chi-square values in the study area appears similar to the one expected from the hypothetical case only in the broadest sense. The decline of chi-square values occurs in steps with high value peaks in 1916, 1920-1928 and 1946-1956. The values decline from these peaks fairly evenly until interrupted by another peak. These interruptions are abrupt changes in value and may be interpreted in two ways. The peak may represent

TABLE 5.3

Category and Chi-square Values - Land Entry and Distance to Settlement*

Time Period		1	2	3	4	5	6	7	8	Chi-square
1	(1908-10)	+513.8	+61.5	+19.3	+3.7	-15.0	-2.5	-11.8	-78.0	705.6
2	(1911)	+5.6	+50.0	+41.9	+31.9	+12.3	0.0	-104.5	-111.1	357.3
3	(1912)	+40.1	+61.4	+26.5	+4.4	-0.4	-5.9	-37.5	-17.6	193.8
4	(1913)	+93.4	+38.0	+36.5	-0.9	-15.4	-6.5	-24.5	-20.0	235.2
5	(1914)	+28.9	+69.3	+5.7	-0.1	-8.0	-24.3	-7.0	-2.0	143.3
6	(1915)	+56.0	+13.9	+2.4	-0.7	+2.9	-32.7	-17.0	ID	125.6
7	(1916)	+219.2	+69.1	+2.2	-12.4	-9.9	-56.0	-20.0	ID	388.8
8	(1917)	+52.9	+83.6	+26.3	-9.9	-11.7	-41.0	-31.0	-5.0	261.4
9	(1918)	+10.1	+81.8	+24.6	0.0	-20.8	-30.0	-29.0	-4.0	200.3
10	(1919)	+6.4	+51.5	+2.1	-4.5	-9.1	-7.0	-12.0	-5.0	97.6
11	(1920-27)	+5.8	+93.0	+16.5	-21.4	-44.2	-30.3	ND	ND	211.2
12	(1928)	+15.6	+124.0	+26.0	-11.2	-78.1	-57.7	ND	ND	312.6
13	(1929)	+14.6	+0.1	+0.3	+0.1	-19.2	-4.5	ND	ND	38.8
14	(1930)	+4.7	+2.5	0.0	-7.5	0.0	-1.5	ND	ND	16.2
15	(1931-38)	+5.0	+8.9	-0.2	-2.3	-15.4	-5.0	ND	ND	36.8
16	(1939-45)	Insufficient Data for Chi-square Calculation								
17	(1946-56)	+120.1	+47.2	+0.1	-23.8	-28.0	-9.0	ND	ND	227.7
18	(1957-68)	+57.1	+10.1	-1.8	-2.3	-4.5	-19.0	ND	ND	83.9

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 3-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

ID - Insufficient data for chi-square calculation
ND - Land not available in this distance category

*Since category values involve squaring the difference between the observed and expected frequencies, sign values are always positive. The use of positive and negative signs in the table only indicate the direction of the departure from the expected frequency i.e. whether the value results from more land (+) or less land (-) than expected being chosen in a particular category.

a significant change in evaluation of the distance categories, in which case a new cycle is begun. An alternate possibility is that the peak is an anomalous value that reflects a condition that has expression in a distance category but is not dependent on a change in distance evaluation.

The peak in 1916 coincides with the extension of the railroad into the study area. It is proposed that this peak is the beginning of a new cycle initiated by a re-evaluation of distance to settlement as a locational factor. This proposal may be supported by the following considerations. With the coming of the railway, two existing post offices became shipping points on the railway and one new post office was established at a shipping point. This meant that these settlements took on important marketing functions in addition to the basic social and service functions they had previously provided. These additional functions may have encouraged a re-evaluation of the relative importance of being close to these centers in terms of other locational considerations. Further, the anticipation of the immediate extension of the railway west of Grande Prairie must have prompted speculation as to the possibility of other established centers becoming shipping points in turn. This may have led to some re-evaluation of available land close to these established centers which would have resulted in a positive choice of these lands in the face of whatever other locational disadvantages they might have had. It is assumed that land still unoccupied close to an established settlement must have had other locational disadvantages.

These same considerations could be applied to the peak values of time periods 11 (1920-27) and 12 (1928). The railway was extended west to Wembley in 1925 and to Hythe in 1928 and may have led to a further re-evaluation of distance to settlements especially those on the railway. The chi-square value of 1928 may have been inflated by the large number of entries in that time period (see p.33). The release of many quarter-sections of school lands, most of which were close to the settled areas, would have tended to increase this value as well.

It is suggested that the final peak in time period 17 (1946-56) was the result of a combination of factors. The first was another re-evaluation of the relative importance of location close to a settlement. Since the only land available at this time was that left over from the preceding settlement expansion, it is likely that this land had many serious disadvantages for agriculture. This being the case, the farmer may have more carefully evaluated the distance to the nearest settlement as one of the few locational advantages. Secondly, the release of much of the rest of the school lands of the study area would have tended to raise the chi-square value of this time period as most of the land was located in the settled areas, and much, presumably, near to settlements.

As mentioned above, there was a consistent choice of land closer to settlement over more distant land. With the exception of the earliest time periods where the positive choice of land reached into the area over 8 miles from a settlement, the critical distance between desirable and undesirable land seems to have been about six to eight miles, while

after 1928 there was a tendency for this distance to be slightly less.

Table 5.4 - Analysis

Table 5.4 sets out the chi-square values for paired distance categories. As in the previous chapters, this treatment is used to disclose the farmers' discrimination (if any) between certain categories of land, and also to identify which of the two categories was preferred. The analysis of this table leads to the following general conclusions:

1) Farmers tended to view distance to settlement as a factor affecting choice of location consistently throughout the time span. Thus, while the strength of distance considerations appears to have changed at particular times, the evaluation of greater distance as least preferred seems to have been very consistent.

2) Discrimination between the pairs of distance categories is most evident in the period of railway expansion, 1916 to 1928. Within this period the farmers tended to disregard distance differences when the land was located less than 5 miles from a settlement. When faced with a choice between 3-4 and 5-6 miles distant he strongly favored the closer land. This same discrimination also was evident between lands 5-6 and 7-8 miles distant and between land 7-8 and 9-10 miles distant.

Table 5.5 - Analysis

In Table 5.5 the distance categories have been consolidated into three groups: 0-6 miles (categories 1-3), 7-10 miles (categories 4-5) and over 10 miles (categories 6-8). The chi-square values for pairs

TABLE 5.4

Chi-square Values for Pairs of Distance Categories - Land Entry and Distance to Settlement (significance level bracketed)

Time Period		Distance Category						
		1&2	2&3	3&4	4&5	5&6	6&7	7&8
1	(1908-10)	44.3 (.001)	5.5 (.02)	5.9 (.02)	18.6 (.001)	6.9 (.01)	4.6 (0.5)	37.6 (.001)
2	(1911)	0.4 (NS)	0.9 (NS)	0.2 (NS)	1.8 (NS)	7.3 (.01)	98.0 (.001)	5.9 (.02)
3	(1912)	2.0 (NS)	3.7 (NS)	3.2 (NS)	3.4 (NS)	21.6 (.001)	16.0 (.001)	0.6 (NS)
4	(1913)	7.1 (.01)	1.5 (NS)	18.4 (.001)	6.7 (.01)	3.3 (NS)	7.5 (.01)	6.6 (.01)
5	(1914)	0.2 (NS)	14.4 (.001)	2.5 (NS)	4.7 (.05)	1.0 (NS)	0.4 (NS)	ID
6	(1915)	10.4 (.01)	2.7 (NS)	2.8 (NS)	3.0 (NS)	31.7 (.001)	7.1 (.01)	ID
7	(1916)	33.7 (.001)	18.7 (.001)	14.7 (.001)	0.0 (NS)	14.1 (.001)	3.6 (NS)	ID
8	(1917)	2.7 (NS)	9.1 (.01)	30.6 (.001)	0.4 (NS)	4.5 (.05)	10.3 (.01)	ID
9	(1918)	0.4 (NS)	11.4 (.01)	9.1 (.01)	17.0 (.001)	0.0 (NS)	11.8 (.001)	ID
10	(1919)	0.9 (NS)	17.6 (.001)	6.4 (.02)	1.5 (NS)	1.3 (NS)	3.1 (NS)	ID
11	(1920-27)	2.2 (NS)	14.6 (.001)	38.0 (.001)	1.7 (NS)	1.1 (NS)	NA	NA
12	(1928)	1.8 (NS)	22.0 (.001)	32.2 (.001)	41.4 (.001)	1.1 (NS)	NA	NA
13	(1929)	7.6 (.01)	0.0 (NS)	0.0 (NS)	17.9 (.001)	0.0 (NS)	NA	NA
14	(1930)	1.4 (NS)	1.5 (NS)	4.8 (.05)	2.8 (NS)	ID	NA	NA
15	(1931-38)	0.0 (NS)	5.0 (.05)	0.9 (NS)	10.9 (.001)	ID	NA	NA
16	(1939-45)	Insufficient Data for Chi-square Calculation						
17	(1946-56)	14.3 (.001)	18.1 (.001)	19.9 (.001)	5.2 (.05)	ID	NA	NA
18	(1957-68)	18.1 (.001)	9.3 (.01)	0.1 (NS)	0.4 (NS)	4.5 (.05)	NA	NA

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

ID - insufficient data for chi-square calculation
NA - no land available in one of the distance categories

TABLE 5.5

Chi-square Values for Pairs of Consolidated Distance Categories - Land Entry and Distance to Settlement (significance level bracketed)

Time Period		Distance Category	
		1-3 and 4-5	4-5 and 6-8
1	(1908-10)	91.8 (.001)	15.6 (.001)
2	(1911)	9.9 (.01)	140.1 (.001)
3	(1912)	32.5 (.001)	30.1 (.001)
4	(1913)	80.6 (.001)	3.3 (NS)
5	(1914)	45.0 (.001)	9.1 (.01)
6	(1915)	10.8 (.001)	40.7 (.001)
7	(1916)	38.2 (.001)	28.7 (.001)
8	(1917)	96.8 (.001)	21.6 (.001)
9	(1918)	60.8 (.001)	25.1 (.001)
10	(1919)	33.0 (.001)	2.2 (NS)
11	(1920-27	132.6 (.001)	2.0 (NS)
12	(1928)	166.8 (.001)	11.3 (.001)
13	(1929)	8.8 (.01)	3.0 (NS)
14	(1930)	112.4 (.001)	0.1 (NS)
15	(1931-38)	17.8 (.001)	ID
16	(1939-45)	ID	ID
17	(1946-56)	103.3 (.001)	ID
18	(1957-68)	15.0 (.001)	4.8 (.05)

Distance Categories:
1) 0-2 miles
2) 3-4 miles
3) 5-6 miles
4) 7-8 miles
5) 9-10 miles
6) 11-15 miles
7) 16-20 miles
8) over 20 miles

ID - insufficient data for chi-square calculation

of these consolidated categories are given in Table 5.5. The purpose of this application of the chi-square test is to reveal the farmers' discrimination between distance categories on a broader scale. The results of this table strengthen the points made above:

1) On lands within 10 miles of a settlement farmers exhibited a strong and consistent preference for land 0-6 miles over land 7-10 miles from a settlement. With two exceptions every time period yields an association between distance and land entry at the .001 level, (*i.e.* the possibility of such an association as the result of chance is only once in a thousand times).

2) On lands 7 miles or more from a settlement farmers exhibited a strong preference for lands 7-10 miles over land more than 10 miles from a settlement in the time span 1908-1918. After 1918 the tendency seems to have been to ignore distance differences between these two categories of land.

3) In these consolidated categories farmers consistently evaluated distance to settlement as a factor in the choice of farm location, as in every time period positive choice favored nearer land over more distant land.

Summary

The purpose of this chapter has been to evaluate the association between the farmers' choice of farm location and the distance to the nearest settlement, a settlement being defined by the presence of a post office. Having determined the location and length of operation of all the post offices in the study area during the time span 1908-1968,

straight-line distances from the center of each quarter-section of land to the nearest settlement were measured by computer. All land entered and all land available for each time period was then classed into distance categories according to the following scheme: 1) 0-2 miles; 2) 3-4 miles; 3) 5-6 miles; 4) 7-8 miles; 5) 9-10 miles; 6) 11-15 miles; 7) 16-20 miles and 8) over 20 miles.

The chi-square test was used in three applications; to all distance categories in each time period, to pairs of distance categories in each time period and finally to pairs of consolidated distance categories for each time period. The major findings of the analyses of these application may be summarized in the following points:

1) The association between distance to settlement and land entry is statistically significant at the .001 level in all time periods but one, and is significant at the .05 level in that time period. It may be concluded that there is a significant association between these two variables, and that such an association as the result of chance is extremely unlikely.

2) By consistently choosing land near settlements over more distant land in all time periods, farmers clearly evaluated distance to settlement as a factor influencing the choice of farm location. While the degree of discrimination appears to have changed at particular periods of time, the discrimination itself was consistently in favor of nearer land over more distant land.

3) The relative importance of distance to settlement in the spectrum of locational factors seems to have been re-evaluated during

the period of railway expansion in the study area. The desirability of being relatively close to a settlement appears to have taken on added significance during this period. It is proposed that this re-evaluation occurred as a result of certain settlements taking on the added function of becoming marketing points on the railway and as a result of speculation that other existing settlements would take on this function due to the anticipated rail extension to the west.

4) The desirability of being close to a settlement became very important in the post-war period as well (1946-56). It is proposed that this was a result of well-located school lands being released to settlement and of an increased desire to locate near settlements to minimize other disadvantages inherent in the land being settled at this time. Reference to this last point will be made in a later chapter.

5) The critical distance between disproportionate choice and avoidance of land appears to have been about 6-8 miles in the period to 1928 and somewhat less in the remaining time span.

CHAPTER VI

LAND ENTRY AND COMBINED VARIABLES

In the preceding chapters an attempt has been made to assess the association and inferred influence of three factors on the process of agricultural settlement in the study area. Each of the three variables has been considered separately and its association with the process of land entry has been examined by means of the chi-square test. This has given rise to three general sets of conclusions. While some brief reference has been made in these chapters to the possible interaction of the variables, an examination of the combined effects of these factors is necessary to a more complete understanding of the process of agricultural settlement.

Two general approaches are utilized in this examination. First, the separate analyses of the previous chapters are drawn together in a comparative way in an attempt to provide some very general statements about the relative importance of these factors in the settlement process. Second, these inter-relationships are detailed by cross-classifying all available land and land entered in each time period with respect to each combination of two variables. The chi-square test is then utilized to examine the resultant associations and patterns of land choice.

Three points must be raised by way of introduction to the discussion:

1) It is assumed that the vegetative cover at the time of survey is not significantly different from the vegetation at the time of

settlement. As a result, the amount of available land in each vegetation category (within the limits set by government restriction and release of land) is reduced only by the process of being occupied. On the other hand, distances to settlements and transportation may vary from time period to time period on a single piece of land due to the extension or deletion of post office facilities or transportation routes. Thus the amount of land available in the distance categories is affected by these extensions and deletions in addition to the factors affecting the vegetation categories. This in turn may lead to a narrowing of choice among the distance categories more quickly than among vegetation categories. If this were true, chi-square values would have a tendency to decline more rapidly due to the decrease in the number of categories and the narrowing of the range of choice.

2) Distances to settlements are distributed around points while distances to transportation are distributed around lines (except in the case of access points on the railway). Unless a great many settlements as defined by post offices, exist apart from "major" transportation routes, the amount of land available in the nearer distance categories will be much more restricted in the case of settlements than in the case of transportation routes. This may also have a bearing on the pattern of chi-square values through time.

3) Post offices need not be associated with a "major" transportation route. Consequently abnormal positive choice of land close to a settlement does not insure high positive choice of land close to a major transportation route, or *vice versa*. The point made in 2) above will also influence differences between the two.

Introduction of these three points was not essential in the earlier treatment of these variables as the patterns of chi-square values were being compared with hypothetical cases where the same variable was assumed to be operative. It is essential that these points be raised now, however, as the pattern of chi-square values for each variable is being compared to the other patterns and not to a hypothetical case.

A. General Comparative Analysis

A consideration of the category and chi-square values from the various tables in Chapters III, IV and V reveals differences in the association of land entry with the three variables. These differences and other general points made previously suggest some conclusions as to the relative influence of these variables of the process of agricultural settlement through time.

Consistency of choice among the categories of all variables appeared to be most evident during the pre-railway period (1908-1915). Farmers in general tended to consistently favor what one would expect to be the "favorable" land over the "unfavorable". They chose land containing some proportion of grassland and avoided scrub, forest and poorly-drained land. They consistently favored nearer land over more distant land in terms of distances to settlements or transportation routes. During this period the probability of association between land entry and any one variable, as indicated by the chi-square value, favors vegetative cover and it may be proposed that this factor was generally more influential in the farmers' choice of land than either

distance to settlement or distance to transportation.

This pattern of consistent preference for "favorable" land continues in the period from 1916 to 1927 except in the 'distance to transportation' variable which reveals a rather haphazard pattern of positive and negative choice of land.[1] It was suggested that this might be due partially to the dominance of another variable in land choice. It should be noted here that a similar disruption in the pattern of choice within the 'distance to settlement' variable, which would seem to be closely related to transportation routes, need not have occurred due to differences in availability of land around points and around lines as noted above. Thus if preference for land close to settlement was the disruptive factor in land choice, the same level of preference for land close to transportation would not necessarily follow even though the post offices were on "major" transportation routes. The land available within two miles of a post office would be only a small part of the land available within two miles of a road, consequently a rush onto land close to a settlement would produce a much larger category value in the 'distance to settlement' category than it would in the 'distance to transportation' category. Also, as noted above, the post office may have been located at some distance from a "major"

---

[1] The use of the terms "positive" and "negative" choice are convenient terms to indicate whether the choice of land in a particular category is greater or less than one would expect under chance conditions.

transportation route. This latter seems to be the most likely explanation during this period as the high positive choices occurred in the most distant categories with respect to 'distance to transportation'.

A case could be made for the influence of vegetative cover during this period as well. Farmers were continuing to choose the "best" land available (transitional groveland and parkland since grassland and groveland were becoming limited). Since post offices were established in areas of population concentration, it would seem reasonable to expect that this same land would be reasonably close to a settlement and category values would be high and positive in the nearer categories as a result. The association between 'distance to settlement' and vegetative cover will be examined in more detail in the next section. It is suggested however that since post offices usually followed settlement, the patterns established by the preference for certain kinds of vegetative cover were basic and the high category values in the 'distance to settlement' categories only reflect this established pattern.

The patterns in the remaining years are not strictly comparable as the time span 1931-68 is treated as a unit in the case of the vegetative cover and is separated into four periods in the case of the distance variables as the many changes in the transportation and post office networks excluded the possibility of using one transportation pattern or one post office network as the basis of measurement over the entire period. It would appear, however, that none of the variables

was especially dominant during this period, although the two distance variables seem to be more probably associated with the process of settlement than vegetation. Near the end of the time span there seems to be a resurgence in the importance of the distance variables. By this time expansion of settlement had forced settlers to select from marginal land in terms of vegetation so it may be postulated that it became increasingly important or desirable to be located close to roads or settlements to compensate for other deficiencies in the land.

In comparing the variables over the entire time span, it would appear that the highest and most consistent levels of association with the process of land entry are exhibited by the variables of vegetative cover and 'distance to settlement'. Both yield category and chi-square values which portray the consistent choice of "favorable" over "unfavorable" land. Both yield chi-square values that reveal high probability of association with the process of land entry throughout the time span. The pattern of decline of these values is generally in keeping with the assumptions proposed in the hypothetical cases where these factors were considered to be important locational determinants. The variable of 'distance to a major transportation route' appears to be the least influential of the three variables, and exhibits the most significant departures from what one would assume to be the case in an area where this was hypothesized as being a locational determinant.

B. Specific Comparative Analyses

This section is devoted to a more detailed examination of the interaction and relative importance of the three variables. The method

utilized is an application of the chi-square test to the observed and expected frequency distribution derived from a classification scheme slightly different from that used previously. The vegetation categories have been consolidated into four groups: 1) grassland and groveland, 2) transitional groveland and parkland, 3) scrub land and forest land and 4) poorly-drained land (open and treed). The distance categories also have been consolidated into four groups: 1) 0-6 miles, 2) 7-10 miles, 3) 11-20 miles and 4) over 20 miles.

All available land and all land entered upon in each time period is then cross-classified separately utilizing each combination of two variables i.e. vegetation and 'distance to settlement', vegetation and 'distance to transportation', 'distance to settlement' and 'distance to transportation'. This method gives sixteen categories in each operation instead of the eight categories in previous examinations. To obtain the number "expected" for each category the following formula was used:

$$e = \frac{a \times o}{n}$$ where

e is the number of quarter-sections "expected" in each category

a is the number of quarter-sections available in each corresponding category

n is the total number of quarter-sections available, and

o is the total number of quarter-sections entered.[2]

The chi-square test is applied and the category value and chi-square values are recorded in tabular form. The analysis of the interaction of the variables is based on the pattern of category values which indicate

---

[2] Pers. comm. Dr. R.A. Mureika, Department of Mathematics, University of Alberta.

"positive" or "negative" choice.

It should be noted that this procedure for obtaining the number expected is not the standard one for a two-way table. The standard procedure is used when no direct way of estimating the probability of obtaining an "expected" outcome is available, but such a way is available here. It is provided by knowledge of the amount of land actually available in each category. It should also be noted that the standard procedure, because it assumes that indefinite amounts of land are available for entry, will produce invalid estimates of the number to be "expected" when little or no land is available in a specified category.[3]

A. Land Entry and Vegetation/Distance to Transportation

The null hypothesis for the chi-square test in this case is: farmers' choice of land was not associated with the kind of vegetative cover nor was it associated with the distance to the nearest transportation route, but was determined by chance i.e. the frequency of choice of lands in each category was proportional to the amount of land available in each category. The category values have been arranged in 16-cell tables to facilitate the interpretation of the patterns of negative and positive values within the total association. The tables given in the text give the values for representative years. For complete values see Appendix D.

There are two basic patterns of positive choice in these tables. Table 6.1 gives the patterns of category values for time period 6 (1915) which is broadly representative of the time span from 1908 to 1927.

---

[3] Pers. comm. Dr. O.F.G. Sitwell, Department of Geography, University of Alberta.

TABLE 6.1

Category Values for 1915 - Land Entry and Vegetation/Distance to Transportation

Distance Categories	Vegetation Categories 1	2	3	4
1 (0-6 miles)	+209.5	+177.8	-24.3	-1.4
2 (7-10 miles)	+18.0	+104.1	-16.1	-5.4
3 (11-20 miles)	+32.0	+64.0	-6.0	-1.4
4 (over 20 miles)	+12.5	+8.1	-28.4	-9.0

Chi-square = 722.0

It is clear from the table that positive choice of land is concentrated under vegetation categories 1 and 2 and persists throughout the distance categories. This suggests that the type of vegetative cover on the land was more closely associated with positive choice of land than was distance to the nearest major transportation route. The inferred dominance of vegetative cover persists throughout this time span (1908-1927) with minor modifications. While the positive choice is most evident in the grassland and groveland category in the early part of this period, it begins to be evident in the transitional groveland and parkland category by time period 4 (1913) and by 1917 the positive choice of land is concentrated in vegetation category 2. This movement of positive choice is to be expected as grassland and groveland became occupied.

The only time period where the distance factor seems to compete equally with the vegetation factor as a locational determinant is time period 2 (1911). The positive choice of land in distance

category 1 (0-6 miles) extends to include land in the scrub and forest land category which in most other time periods is avoided. The desire for grassland and groveland is equally evident though because this type of land was preferred to other types in all distance categories in which it was available.

High positive values for poorly-drained land in 1918 and 1920-1927 are the result of the large block of land purchased and drained in 1918-1921 as has been explained in previous chapters. While there are other small anomalies in the general pattern described, the general trend indicates vegetation as the dominant locational determinant. There is also a rather apparent distinction in choice between vegetation categories 1 and 2 and categories 3 and 4.

The pattern of positive choice changes in 1928 and this new pattern holds to the end of the time span. Table 6.2 gives the distribution and size of the category values for 1928 which is representative of the patterns to be found in the time span 1928-68.

TABLE 6.2

Category Values for 1928 - Land Entry and Vegetation/Distance to Transportation

Distance Categories		Vegetation Categories			
		1	2	3	4
1	(0-6 miles)	+96.8	+27.6	+1.3	-13.8
2	(7-10 miles)	NA	ID	-49.1	-2.0
3	(11-20 miles)	ID	-1.0	-15.6	ID
4	(over 20 miles)	NS	NA	NA	NA

Chi-square = 207.2

ID - insufficient data for calculation
NA - no land available in this category

Here the linear pattern of positive choice is oriented along the nearest distance category with little, if any regard for vegetation. This pattern is similar although the category values are not as high, in the last two periods (1946-56 and 1957-68). All of these time periods have a common characteristic however — substantial amounts of school land were released in each of these periods. Since the release of these lands to settlement awaited local pressure for their use, it is reasonable to suppose that many quarter-sections occurred near roads and consequently fell into the nearest distance category. It is likely then that when local pressure forced the sale of these lands, they were occupied because they would add to a local farmer's holdings rather than because they were close to a transportation route. The highest values occurred in the grassland and groveland category which indicated a continuing awareness of the desirability of these kinds of vegetation even in the last time period.

In the intervening years (1929-1945) the pattern is such that there is no clear indication as to the relative importance of the factors. Only land in vegetation category 3 (scrub and forest land) and distance category 1 (0-6 miles) yielded positive category values. This might be taken as an indication of the importance of distance since all occurred in the nearest distance category. On the other hand, land in the first two vegetation categories was becoming scarce and it is possible that most of the small amount of land available in these categories was technically restricted as school land. This would give a negative value in these categories that was

not truly representative of the choice based on availability of land. Even if distance is taken to be the dominant factor, the desire to be close to transportation did not outweigh the avoidance of poorly-drained land as no positive values occur in this vegetation category.

B. Land Entry and Vegetation/Distance to Settlement

The null hypothesis for this section is: Farmers' choice of land was not associated with vegetation nor was it associated with distance to the nearest settlement, but was determined by chance. Table 6.3 gives the size and distribution of the category values for time period 6 (1915) which generally represents the pattern evident in the years between 1908 and 1927. It is interesting to note that a comparison of this table and Table 6.2 reveals very little land available more than 20 miles from a settlement, but a considerable amount available 20 miles from a transportation route. This would indicate that post offices preceded major transportation routes into newly opened areas.

TABLE 6.3

Category Values for 1915 - Land Entry and Vegetation/Distance to Settlement

Distance Categories	Vegetation Categories 1	2	3	4
1 (0-6 miles)	+71.3	+123.1	+0.4	-5.9
2 (7-10 miles)	+130.7	+169.9	-38.0	-5.8
3 (11-20 miles)	+40.5	+16.7	-75.7	-7.0
4 (over 20 miles)	NA	NA	ID	NA

Chi-square = 685.0

ID - insufficient land available for calculation
NA - no land available in this category

This table reflects again the relative importance of the vegetation variable in location choice, but the influence of distance to settlement has modified this pattern to a greater extent than in the case of distance to transportation. The positive choice in the 0-6 miles category has extended to include vegetation category 3 (scrub and forest land) which was not evident in A. above. The departures from the pattern given for 1915 are infrequent and more in the nature of modifications of the basic pattern. For example, distance seems to have had little or no effect on the importance of the vegetation variable in time periods 1 to 3 (1908-1912). The patterns are the same as those found in A. for the same periods. In the later stages of this time span, in particular from 1918 to 1927, the whole pattern of positive choice moves over one vegetation category. This is due to the decrease of available land in the grassland-groveland category and the subsequent movement of the range of positive

choice to include the poorly-drained land within distance category 1 (0-6 miles). It could be argued that the influence of distance to settlement was strong enough to warrant even the poorly-drained land being taken in the closest distance category, but again, the drainage of the large block of land in 1918-21 produced high anomalous values especially in time periods 9 and 11 (1919 and 1920-27).

Table 6.4 gives the category values for time period 12 (1928) which, with minor modifications, is generally representative of the years between 1928 and 1968.

TABLE 6.4

Category Values for 1928 - Land Entry and Vegetation/Distance to Settlement

Distance Category	Vegetation Category			
	1	2	3	4
1 (0-6 miles)	+96.8	+20.3	+104.4	-6.2
2 (7-10 miles)	NA	ID	-60.1	-7.2
3 (11-20 miles)	ID	0.0	-58.1	-2.3
4 (over 20 miles)	NA	NA	NA	NA

Chi-square = 355.4

ID - insufficient land for calculation of expected frequency
NA - no land available in this category

The pattern is very similar to the one found in A. above, and the points presented there apply equally well here. One difference is that in A. the size of the category values progress from highest to lowest within the 0-6 mile category in the order one would expect if vegetation was still being evaluated critically. Here, there is no such order and this would suggest one of two things: a) the

proportions of land available in the vegetation categories 0-6 miles from a transportation route were significantly different from those 0-6 miles from a settlement, thus affecting the size of the category values, b) distance to settlement was more a modifying influence on the preference for vegetation than was distance to transportation. Since the amounts of land available in each vegetation category were almost identical in the two cases, the latter proposal seems to be the more acceptable.

In the last time period (1957-68), positive choice of land in the 0-6 mile category extends through all the vegetation categories which emphasized the relative importance of land close to settlement in the end of the time span when settlement was being forced onto physically marginal land. Again, the high positive choices in the grassland-groveland category at this late date can be attributed to the release of school land which had been technically restricted until this time. The years from 1929-1945 reveal the same patterns described in A. above with positive choice of land being restricted to scrub and forest land in distance category 1 (0-6 miles) with only one exception.

C. Land Entry and Distance to Transportation/Distance to Settlement

The null hypothesis here is: farmers' choice of land was not associated with distance to transportation nor was it associated with distance to settlement but was determined by chance.

The category values for this combination of variables are somewhat more irregular than those of the preceding sections. The

basic patterns are reasonably clear but within these patterns the size of the category values indicate little evidence of the two factors operating in a consistent manner with respect to each other. For example, in Table 6.5, which gives the general pattern for the first three time periods (1908-1910, 1911 and 1912), distance to transportation seems to be exerting the dominant influence on land choice. Yet within transportation distance category 1 (0-6 miles) there seems to be no preference for land close to settlement over more distant land. This would seem to indicate that either distance to transportation is so strong in this period as to take no account of distance to settlement, or that some other factor, distributed in the closest distance to transportation category is operative.

TABLE 6.5

Category Values for 1911 - Distance to Transportation/Distance to Settlement

Settlement Distance Category	Transportation Distance Category			
	1	2	3	4
1 (0-6 miles)	+191.9	-33.4	+2.4	NA
2 (7-10 miles)	+330.9	-25.9	-27.3	NA
3 (11-20 miles)	+3.9	-21.3	-26.7	-77.0
4 (over 20 miles)	-71.1	-18.0	NA	-27.0

Chi-square = 856.8

NA - no land available in this category

The representative pattern of 1911 is modified in time period 1 (1908-10) where positive choice of land is evident in transportation distance categories 1 and 2 (0-6 miles and 7-10 miles), with the positive choice extending into settlement distance category 3 in the latter case. Another slight modification in time period 3 (1912) shows positive choice of land in transportation distance category 1 (0-6 miles) extending right through the four distance to settlement categories.

In the first three time periods then, distance to transportation appears to be more probably associated with land entry than distance to settlement. Lack of consistency in the size of the category values however might suggest that some other factor is exerting an influence on this pattern even though it is distributed in such a way as to lend weight to the distance to transportation factor.

Table 6.6 gives the category values for time period 7 (1916) which is generally representative of the time between 1913 and 1927.

TABLE 6.6

Category Values for 1916 - Distance to Transportation/Distance to Settlement

Settlement Distance Category	Transportation Distance Category			
	1	2	3	4
1 (0-6 miles)	+18.3	-18.7	+212.6	-1.8
2 (7-10 miles)	-9.5	-7.7	-5.8	-1.7
3 (11-20 miles)	-25.0	-14.2	-16.0	-23.6
4 (over 20 miles)	NA	NA	ID	ID

Chi-square = 354.9

ID - insufficient available land for calculation of expected frequency

NA - no land available in this category

The pattern of positive choice for this time span changes from a dependence on distance to transportation to dependence on distance to settlement. Although minor modifications of this pattern are apparent in the category values for other time periods in this span, the orientation of positive choice is clearly related to settlement distance category 1 (0-6 miles).

Category values for time periods 5 and 6 (1914 and 1915) appear to suggest a transition from the dominance of distance to transportation to the dominance of distance to settlement. Positive choice of land is concentrated in the 0-6 mile distance to settlement category, but in the two nearest distance to transportation categories, it extends into the 7-10 mile distance to settlement category. After 1916 however, there are only minor departures from the representative

pattern. In most instances positive choice of the 0-6 mile distance to settlement category extends through all the distance to transportation categories. In one case there is an additional slight positive choice for land 7-10 miles from settlement and over 20 miles from transportation.

In the time span 1915-1927, the more important variable in land choice appears to have been distance to settlement although once more the irregular occurrence of high positive category values might suggest the operation of another variable.

The pattern of positive choice in the category values of time period 12 (1928) given in Table 6.7 is duplicated in every subsequent time period but one, although the size of the values are not identical. The one exception is in time period 13 (1929) where there is an additional positive choice of land 0-6 miles from transportation and 7-10 miles from settlement.

TABLE 6.7

Category Values for 1928 - Distance to Transportation/Distance to Settlement

Settlement Distance Category		Vegetation Distance Category			
		1	2	3	4
1	(0-6 miles)	+136.8	-2.0	ID	NA
2	(7-10 miles)	-24.9	-33.2	-12.3	NA
3	(11-20 miles)	-35.6	-23.0	-1.7	NA
4	(over 20 miles)	NA	NA	NA	NA

Chi-square = 269.5

ID - insufficient land available for calculation of expected frequency
NA - no land available in this category

During this period (1928-68) there is a remarkable consistency in the pattern of positive choice of land close to both transportation and settlement. Thus, while it is impossible to suggest which of the two factors might be the more important determinant of location choice, it is apparent that distance considerations in total were highly associated with land entry during this period. This in turn suggests a relative decline in the importance of vegetation as the dominant locational determinant in the latter stages of the process of agricultural settlement.

Summary

Two general approaches have been utilized in the examination of the interaction and relative importance of the variables of vegetative cover, distance to the nearest major transportation route, and distance to the nearest settlement. The patterns of category and chi-square values and the conclusions of the chapters dealing with these three variables separately have been compared first. Second, the chi-square test has been applied to the distribution of observed and expected frequencies based on a cross-classification of land entered and available according to each combination of two variables. These operations have led to several general conclusions regarding the interaction and relative importance of these variables in the process of agricultural settlement:

1) Vegetative cover appears to have been the most probable determinant of farm location choice in the period 1908-1927.

2) Distance to transportation and distance to settlement considerations modified this general pattern only slightly during this time period. Distance to transportation appears to have been the more important modifier in the period 1908-1913 while distance to settlement appears to have been more important in the period 1914-1927.

3) Distance considerations, both to transportation and to settlement, appear to have been the most likely determinants of farm location choice in the period 1928-1968. This is not to ignore the fact that, where available, farmers chose land within the nearest

distance categories in a consistent manner, preferring grassland-groveland to transitional-groveland-parkland and so on through to poorly-drained land.

4) In the period of vegetation dominance, there was a clear break between positive choice of lands in the grassland to parkland categories and avoidance of the scrub to poorly-drained categories.

5) In the period of distance dominance, the general pattern indicates that the point separating choice and avoidance of land fell between the 0-6 mile and 7-10 mile categories.

CHAPTER VII

THE PROCESS OF AGRICULTURAL SETTLEMENT IN THE SOUTH PEACE REGION

A brief general account of the settlement of the study area has been given in Chapter II. Here an attempt is made to put the process of agricultural settlement into historical perspective with particular emphasis on the variables discussed previously. This allows a qualitative consideration of other variables that may have modified or amplified the influence of the variables discussed quantitatively. In addition, agricultural settlement may be portrayed as a coherent and continuous process influenced and modified in its spatial expression by a variety of local, regional and national factors. As is the case throughout this study, the focus here is upon new agricultural expansion without regard for the subsequent success or failure of such settlement. Figures 5 to 11 in Appendix C indicate the extent of agricultural settlement at selected dates, and Figures 12 to 15 give the parcels of land patented at selected dates. Combined, these figures give a good indication of the rate and direction of agricultural settlement in the study area.

The beginnings of agriculture in the Peace River region go back to the fur-trading posts of the Northwest Company and Hudson's Bay Company established along the Peace River near the end of the eighteenth and early years of the nineteenth centuries. The factors were encouraged to keep small kitchen gardens to supplement their food

supply and a few attempted small plots of barley and other grain. The posts along the Peace River were recognized as potential provisioning points for the Athabasca and McKenzie's River Districts as early as 1834.[1] The relative success of these small beginnings of agriculture in the valley of the Peace River prompted much speculation as to the general suitability of the whole area for crop cultivation. Among the scientists, surveyors and adventurers who later inspected the area either in detail or in passing, opinion was sharply divided on this point, with Horetzky, Dawson and John Macoun among the most vociferous promoters of the area and Ogilvie, Somerset, Pike and James Macoun among the most ardent dissenters.[2] In the final analysis the views of the optimists prevailed and a sustained movement of would-be farmers into the area began about 1909.

---

[1] Innis, H.A., The Fur Trade In Canada, Un. of Toronto Press, Toronto, 1962, p. 300.

[2] For these opinions see: Horetzky, C., Canada on the Pacific, Dawson Brothers, Montreal, 1874, p. 30; Horetzky, C., Startling Facts, Free Press, Ottawa, 1880, pp. 19, 20; Dawson, G.M., "Report of an Exploration From Port Simpson on the Pacific Coast, to Edmonton on the Saskatchewan, Embracing a portion of the Northern Part of British Columbia and the Peace River Country", Canadian Geological Survey, Report of Progress - 1879-1880, Dawson Brothers, Montreal, 1880, pp. 69B, 72B, 74B; Canadian Pacific Railway, Report of Progress on the Explorations and Surveys up to January, 1874, MacLean, Roger and Co., Ottawa, 1874, pp. 47, 48, 84, 93-95; Ogilvie, Wm., Report on the Peace River and Tributaries in 1891, Canada, Department of the Interior, Queen's Printer, Ottawa, 1892, pp. 36; Somerset, S.H., The Land of the Muskeg, William Heinemann, London, 1895, pp. 30, 31, 95, 96; Pike, Warburton, The Barren Ground of Northern Canada, Macmillan and Co., London, 1892, pp. 223, 224; Macoun, James, Report on the Peace River Region, Geological Survey of Canada, King's Printer, Ottawa, 1904, pp. 5E, 25E.

The first permanent white settlement in the study area was the Hudson's Bay post at Cutbank Lake, built in 1881 by Tom Kerr.[3] George Kennedy, who was in charge of the post, made the first recorded attempt at cultivation when he planted potatoes on a plot of land near La Glace in that same year.[4] A few gold-seekers bound for the Klondike in 1898 decided to establish themselves at Lake Saskatoon instead, and it was here that the first grain was grown in 1900 by Alex Monkman and Louis Callihoo.[5] Cattle were brought into the area as early as 1902 and in 1906 Mead and Grant set up a ranching operation near Lake Saskatoon.[6] Several families had moved into the Beaverlodge area in 1902 with a view to farming, but they became discouraged and were on their way out of the area in 1903.[7] A.M. Bezanson came into the area in 1906 and after appraising the area located on a well-wooded site near the confluence of the Wapiti and Smoky Rivers with a view to establishing a sawmill to supply future settlers with lumber. The Cliffords came in 1906, settling near Flyingshot Lake, southwest of the site of

---

[3] Campbell, I.M., Grande Prairie - Capital of the Peace, n.p., 1968, p. 3.

[4] Albright, W.D., "History of Agriculture, Grande Prairie District", Grande Prairie Herald, Old Timers' Historical Edition, Dec. 21, 1934, p. 4.

[5] *Loc. cit.*

[6] Campbell, *op. cit.*

[7] Macoun, James, *op. cit.*, p.23E; Campbell, *op. cit.*, p. 2.

G. Bredin's blacksmith shop and stopping place which he built in 1905-1906,[8] while the Stones and Johnsons settled in the Beaverlodge area in 1908.[9] The preference for certain kinds of locations in keeping with the intended occupations of the settlers was evident in the choice of location of these and other early settlers. Clifford, Mead, Grant and Monkman, all ranchers, chose grassland areas close to lakes, Bezanson chose a well-wooded river site in anticipation of a town-site and consequent demand for lumber. The farmers chose well-drained grassland sites.

The beginning of a sustained movement of agricultural settlers into the study area in 1909 was due to several factors, almost all of which were important in the larger movement of agricultural settlers into Western Canada in the previous two decades. Large scale movement of settlers into the "parkland" areas of central Alberta and Saskatchewan was beginning to force the settlement of physically marginal lands, so attention was directed to the last reserves of good agricultural land in the more northerly areas, the largest of which was the Peace River area. This interest was encouraged by an active promotional campaign that capitalized on the large areas of grassland and the anomalous climate and generally ignored or rationalized the

---

[8] Campbell, op. cit., p. 5.

[9] McGregor, J.G., The Land of Twelve-Foot Davis, The Institute of Applied Art, Ltd., Edmonton, 1952, p. 354.

hazards of the area. As the introduction of Red Fife into the prairies of Western Canada was one pre-requisite to the settlement of that area, so the introduction of Marquis, a faster maturing variety of wheat, into the Peace area in 1909 was a necessary prerequisite for successful agricultural settlement there. It allowed the farmer to overcome partially the one hazard that could not be ignored — the frost hazard. In addition to these factors, the Peace region had a certain mystique about it, a feeling of the "last frontier", that tended to emphasize its attractions and to mitigate its hazards.

Settlers came into the area in increasing numbers in 1909 and 1910. The construction of a new trail from Edson to the area via Sturgeon Lake in 1911 reduced the travelling distance into the area drastically and this encouraged a major influx of settlers in that year.[10] This active expansion of settlement continued until 1919 with an average of four hundred new entries a year. It seems clear from the analysis in previous chapters and from a consideration of the figures in Appendix C that a basic locational determinant during this period was the availability of grassland. The large influx of settlers in 1911 chose land generally within the extensive grassland area that reached from Grande Prairie and Lake Saskatoon in the south to La Glace and Sexsmith in the north (see Figure 3). Two small groups of settlers appeared in the grassland areas near Hythe and Beaverlodge

---

[10] For detail on some of these early trails see McGregor, J.G., op. cit., pp. 287-309; 361-369; Tracie, C.J., Agricultural Settlement in the South Peace River Area, Unpublished M.A. Thesis, Un. of Alberta, 1967, (map) p.30.

as well. Incoming settlers in the next two years generally chose unoccupied land within the larger grassland area, but there were extensions of settlement into the area north of La Glace, south and east of Bezanson and south-west of Beaverlodge. Extension of the fringes of settlement particularly south-west of Beaverlodge, north-east of Sexsmith and near Valhalla Centre was characteristic of the land entries in 1914 and 1915.

The extension of the railway to Grande Prairie in 1916 appeared to have little effect on the pattern of choice in that year, although there was a filling in of a few quarters of land near the railway in the northern area. The bulk of the expansion in this year was concentrated in the Valhalla Centre and Hinton Trail areas, both of which were a considerable distance from the railway but which had some areas of semi-open grassland still available. The expansion of settlement continued to be concentrated in the western fringes in the years between 1916 and 1919 with a noticeable closing in of the fringe around Saskatoon Hill.

World War I seems to have had little effect on agricultural expansion as indicated by land entry, but this does not present the whole picture. New entries were being made every year, but many men were leaving the area to enlist at this time as well. Again, at the end of the war, the influx of settlers into the area was much greater than the land entries suggest as many veterans returned to the area to occupy the land they had entered upon previously.

The close association between land entry and area of grassland

during this period (1908-1919) is not surprising. By this time farmers had long since abandoned the notion of the sterility of the grassland areas and were also equipped with implements suited to breaking up the prairie sod. Some of the open grassland areas were large but no location was far from an adequate supply of timber for fuel and construction. The grasslands furnished high-quality hay for horses and cattle and presented no impediment to the immediate plowing of the land. It is interesting to note that farmers tended to acquire land with as great a proportion of grassland as possible. There is little evidence of a concern for a mixture of grassland and woodland in choice of location. Another point that must be made again is that entries during this period were not restricted to grassland or groveland. Many other factors, though perhaps not dominant in the general process of settlement, were of major importance in individual selections of farm location.

The rate of farm expansion dropped off sharply in the years 1920 to 1926, but began to recover in 1927. This was probably a reflection of the post-war recession and the drop in wheat prices that accompanied it. The recession began in 1920, deepened during the next three years, and began to lift in 1924.[11] The agricultural situation in the study area was not the most attractive either as four poor to fair crop years were recorded in the seven years between

---

[11] Lower, A.R.M., Colony to Nation, Longman's, Green & Co., Toronto, 1951, pp. 495-497.

and including 1919 and 1925.[12] This is not to suggest that agricultural development came to a halt. Returned veterans were improving the holdings they had left during the war and a moderate amount of new land was being occupied.

The settlers during this period continued to regard the vegetative cover as perhaps the most important consideration in location choice. By that time, most of the grassland and groveland areas had been occupied and preference turned to the next most open land, transitional groveland and parkland. The extension of agricultural settlement during this period (1920-1927) was confined primarily to the fringes of the occupied land in the northern, western and southern areas. Although vegetation seems to have been the dominant locational consideration the extension of transportation routes during this period appears to have had an effect on some location selecton. There were quite a number of quarters occupied along the southern fringe of settlement which paralleled the extension of the railway to Wembley in 1925. The extension of settlement north-west of Hythe occurred along the highway that had been built to the British Columbia border during this same time period.

The combination of a booming national economy, high wheat prices and two excellent crops in the study area in 1927 and 1928 produced a

---

[12] Albright, W.D., "History of Crop Conditions in the Peace River District", Manuscript Table, Alberta Legislative Library, Edmonton, n.d.

peak of land entry in 1928 and 1929 only slightly less important than the peak in 1911. It would appear that in these years (1928-29) the distances to transportation routes and settlements were becoming the dominant factors in the process of settlement location, although farmers were still discriminating between "favorable" and "unfavorable" vegetative cover. Many school sections were released to settlement in 1928, all of which were located within the area of established settlement and many of which fell into the grassland, groveland and transitional groveland categories. Most of these school lands were purchased by local farmers to enlarge their holdings so it is likely that distance to the home quarter was a major determinant in the case of these lands. The majority of the entries of 1928 and 1929 contributed to new settlement expansion however. Land around Saskatoon Hill, largely avoided until this time, was being occupied, perhaps partially in response to the extension of the railway to nearby Beaverlodge in 1928. A limited rush in to the Teepee Creek area took advantage of small parcels of semi-open land. A road had been built to Teepee Creek during the previous time period (1920-1927) and a post office had been established there in 1924. These factors no doubt encouraged settlement in this area as well. The establishment of roads and post offices in the area south-west of Beaverlodge contributed to the expansion of settlement in that area and settlement continued in the area north-west of Hythe.

It is difficult to determine exactly the effect of the depression (1930-1938) on the process of land settlement in the study

area. Certainly the large numbers of entries in 1930, and perhaps some from 1929, were due in large part to the influx of disillusioned farmers from the southern droughty areas of Saskatchewan and Alberta. The expansion of new farmland dropped sharply in 1931 and in the years until 1938 averaged only twenty a year. As mentioned above, the total effect of incoming settlers is not apparent in settlement expansion. A great many of these farmers re-occupied lands that had been found marginal and had been abandoned in previous years. Settlers during this time appeared to be more concerned with distance considerations than with vegetative cover. Extension of settlement was confined mainly to the fringes of the established areas, particularly in the west and in the Teepee Creek-Webster areas.

There was a cessation of new settlement during the Second World War. Only twelve new entries were recorded between 1939 and 1945. Two minor peaks of expansion occurred after the war. The first, in the years of 1946 and 1947, was no doubt the result of an active campaign to establish veterans on farms. The second occurred in the years 1963 to 1966 and may have been encouraged by an optimistic agricultural outlook. These were minor expansions confined primarily to the Teepee Creek-Bad Heart area and to the filling in of more school land and isolated quarters within the established settlement area. Actually, the outer boundaries of agricultural settlement had been established basically by 1930. Only the least favorable land in terms of vegetative cover was left and it is likely it would have remained unoccupied had it not been for the introduction of the bulldozer into

common use as an efficient means of clearing and breaking of forest land.

Distance considerations seem to have been the most likely locational determinant in the post-war years. It seems reasonable that since the choice of land had been so narrowly restricted in terms of vegetation it became increasingly desirable to be located near a major transportation route or settlement in order to minimize other deficiencies. It is likely too that the expansion of new settlement in the fifties and sixties occurred as a result of additions to established farms as sons took over their fathers' farms and were able to enter on land in their own right. If this were the case much of the new settlement would be concerned with nearness of land to the home quarter and the farmer would make the best of land that was very near rather than enter upon more favorable land that was located at some distance from the home quarter.

In summary then it appears that: a) the basic outlines of agricultural settlement were fairly well established by 1930, and were determined in the main by the farmers' preference for areas of open or semi-open grassland. b) Settlement expansion after 1930 was very slow, confined in the most part to minor expansions of the fringes of established settlement and most likely associated with the development of transportation routes and the establishment of settlements. c) Fluctuations in the rate of settlement expansion must be explained in terms of the far-reaching effects of national social and economic factors in addition to local and regional factors. d) The examination

of the process of agricultural settlement as defined in this study presents only a partial view of the total movement of people into and out from the study area.

CHAPTER VIII

CONCLUSIONS

The process of agricultural settlement in the South Peace River region has been examined in terms of three variables that are considered important, although not the only, locational determinants in agricultural settlement, particularly in the "parkland" areas of North America: vegetative cover, distance to the nearest transportation route and distance to the nearest settlement. The evaluation of the importance of these variables through time has been accomplished by a quantitative assessment of the association between the process of land entry and the three variables, separately and in combination, utilizing the chi-square test. The limitations of this test were recognized, especially in evaluating strength of association, but it is proposed that this test is a straightforward and useful analytical test for determining the general importance of certain variables in the settlement process. Although several qualifications have been made with regard to each of these variables in the settlement process (see the separate and combined analyses in the previous chapters) the major findings of this study may be set out in the following points:

1) Vegetation appears to have been the dominant locational determinant in the process of agricultural settlement in the study area in the period 1908 to 1927.

a. Within this period there was a consistent preference for land with over 20 per cent grassland (grassland to parkland

vegetation categories) over other land (scrub land to poorly-drained vegetation categories).

b. The dominance of the vegetation variable appears to have ended about the time (1927) that the grassland to parkland categories of vegetation became generally unavailable.

2) Vegetation was evaluated consistently in terms of preference over the entire time span (1908-1968) i.e. grassland was chosen over groveland, groveland over transitional groveland and so on through to the poorly-drained categories.

3) Distance considerations, both to transportation and to settlement, appear to have been the dominant locational determinants in the time period 1928-1968.

a. Distance to settlement appears to have been more important than distance to transportation in the selection of location in this time period.

b. The critical distance between relative choice and avoidance of land appears to have been between five and eight miles from a settlement or transportation route.

4) The basic limits of agricultural settlement were established by 1930. Subsequent new settlement was confined to a narrow fringe around this established area and to a filling in of previously unoccupied land (some of which was restricted) within the settled area.

An attempt has been made to analyze certain locational variables in order to provide a meaningful description and interpretation of the process of agricultural settlement in the South Peace River region in the period 1908 to 1968. A broader aim has been to assess quantitatively the relative importance of three basic locational variables in the process of agricultural settlement of a specific area and to contribute to a better understanding of agricultural settlement process in general. A logical extension of this study would be the examination of a similar area utilizing the same methodology to determine the extent to which the findings of this study can be generalized in similar areas particularly in western North America. The analytical tool (the chi-square test) employed in this study is neither new nor without limitations. The author feels however that it allows a quantitative evaluation so necessary to an understanding of the actual process of settlement in a manner that is comprehensible to persons relatively unfamiliar with the complexities of statistical analysis.

This study has been concerned with the process of agricultural settlement as defined by the entry of settlers upon land previously unoccupied. In view of this primary concern, no attempt has been made to assess the evolution of settlement patterns, nor to evaluate the relative success or failure of areas or times of settlement. A consideration of these topics within the context of this study could suggest several useful lines of enquiry. Having considered the relative importance of several locational variables in the settlement

process, it would be useful to identify any expression they might have in the evolution of settlement patterns. Have the farms that have been established in the grassland areas been more successful than those of the scrub or forest areas? Can differences in pattern of settlement be ascertained in a comparison of the two kinds of areas? Perhaps farms located near major transportation routes or settlements have been more successful. Length of time between entry and patent, number of cancellations on the land before patent, farm consolidation, farmstead form and function are some indicators that might be useful in determining the relative "success" or "failure" of settlement. Have certain kinds of land policy (homestead, South African Scrip, soldier's grants, homestead lease and sale etc.) been more successful than others, and can the land entered under each of these policies be correlated in some way with success or failure of settlement as measured by some of the above indicators? These and many related topics would add significantly to an understanding of the relationship between the process and pattern of agricultural settlement.

BIBLIOGRAPHY

Albright, W.D., "History of Agriculture, Grande Prairie District", Grande Prairie Herald, Old Timers Historical Edition, Dec. 21, 1934.

________, "History of Crop Conditions in the Peace River District" Unpublished Manuscript, n.d. (Alberta Legislative Library).

Anon., "Agriculture and Transportation in the Peace River District", Farm and Ranch Review, Vol. 23, Nov. 25, 1927, pp. 8-9.

Barrows, H.H., "Geography of the Middle Illinois Valley", Illinois State Geol. Survey, Bull. 15, 1910, pp. 64-125.

Bird, J.B., "Settlement Patterns in Maritime Canada 1687-1786", Geogr. Rev., Vol. 45 (1955), pp. 385-404.

Bird, R.D., Ecology of the Aspen Parkland of Western Canada In Relation To Land Use, Canada Department of Agriculture, Ottawa, 1961, 155 pp.

Blalock, H.M., Social Statistics, McGraw-Hill Book Co. Inc., New York, 1960, 465 pp.

Bourdo, E.A., "A Review of the General Land Office Survey and of Its Use in Quantitative Studies of Former Forests", Ecology, Vol. 37 (1956), pp. 754-768.

Brown, R.H., "Forest Openings of the Chickahominy Peninsula", AAAG, Vol. 30 (1940), p. 49.

Bylund, E., "Theoretical Considerations Regarding the Distribution of Settlement in Inner North Sweden", Geogr. Annaler, Vol. 42, pp. 225-231.

Campbell, I.M., Grande Prairie Capital of the Peace, n.p., 1968, 146 pp.

Canada, Department of Transport, Meteorological Branch, Climatic Normals, Vol. I (Temperature) and II (Precipitation), Toronto, 1968.

Canadian Pacific Railroad, Report of Progress on the Explorations and Surveys up to January, 1874, Report of J. Macoun and C. Horetzky, MacLean, Roger and Co., Ottawa, pp. 46-98.

Cant, R.G., "The Agricultural Frontier in Miniature: A Microstudy on The Canterbury Plains, 1850-1875", New Zealand Geographer, Oct., 1968, pp. 155-167.

Cowles, H.C., "Persistence of Prairies", Ecology, Vol. 9 (1928), pp. 380-382.

Curtis, J.T., The Vegetation of Wisconsin, Un. of Wisconsin Press, Madison, 1959, 657 pp.

Dawson, C.A., The Settlement of the Peace River Country: A Study of a Pioneer Area, Vol. VI of The Canadian Frontiers of Settlement Series, W.A. MacIntosh and W.L.G. Joerg (eds.), The Macmillan Co. of Canada Ltd., Toronto, 1934, 284 pp.

Dawson, G.M., "Report of An Exploration From Port Simpson on the Pacific Coast, to Edmonton on the Saskatchewan Embracing a portion of the Northern Part of British Columbia and the Peace River Country", in Report of Progress - 1879-1880, Canadian Geol. Survey, Dawson Bros., Montreal, 1881, pp. 46B-91B.

Enequist, Gerd, "Advance and Retreat of Rural Settlement in Northwestern Sweden", Geogr. Annaler, Vol. 42 (1960), pp. 211-219.

English, P.W., "Landscape, Ecosystem and Environmental Perception", Journ. of Geogr., April, 1968, pp. 198-205.

Foscue, E.J., "Influence of Contrasted Soil Types Upon Changing Land Values Near Grapevine, Texas", AAAG, Vol. 28 (1938), pp. 137-144.

Gregory, S., Statistical Methods and the Geographer, Longman's, Green & Co., London, 1963, 240 pp.

Hansen, H.P., "Postglacial Forests in the Grande Prairie - Lesser Slave Lake Areas of Alberta, Canada", Ecology, Vol. 33 (1952), pp. 31-40.

Hewes, L., "Some Features of Early Woodland and Prairie Settlement in a Central Town County", AAAG, Vol. 40 (1950), pp. 40-57.

________, "The Northern Wet Prairie of the United States: Nature Sources of Information, and Extent", AAAG, Vol. 41 (1951), pp. 307-323.

Horetzky, C., Canada On the Pacific, Dawson Brothers, Montreal, 1874, 244 pp.

________, Some Startling Facts Relating to the Canadian Pacific and the North West Lands, The Free Press, Ottawa, 1880, 76 pp.

Hudson, J.C., "A Location Theory for Rural Settlement", AAAG, Vol. 59 (1969), pp. 365-381.

Imrie, J.M., Peace River An Empire in the Making, The Edmonton Journal, Edmonton, 1929, 32 pp.

Innis, H.A., The Fur Trade in Canada, Un. of Toronto Press, Toronto, 1962, 446 pp.

Johnson, H.B., "Rational and Ecological Aspects of the Quarter-Section", Geogr. Rev., 1957, pp. 330-348.

Johnston, W.B., "Locating the Vegetation of Early Canterbury: A Map and Its Sources", Trans. Roy. Soc. New Zealand (Botany), Vol. 1, No. 2, 1961, pp. 5-15.

Jordan, T.G., "Between the Forest and the Prairie", Agricultural History, Oct., 1964, pp. 205-216.

Kaatz, M.R., "The Black Swamp: A Study in Historical Geography" AAAG, Vol. 45 (1955), pp. 1-35.

Kohn, C.F., "Settlement Forms and Patterns", in The North American Mid-West, A Regional Geography, J.H. Garland (ed.), New York, 1955, pp. 28-39.

________, "Settlement Geography" in American Geography; Inventory and Prospect, P.E. James and C.F. Jones (eds.), Syracuse Un. Press, Syracuse, 1954, pp. 125-141.

Kuchler, A.W., "Localizing Vegetation Terms", AAAG, Vol. 37 (1947), pp. 197-208.

________, "Some Uses of Vegetation Maps", Ecology, Vol. 34, (1953), pp. 629-636.

________, "Classification and Purpose in Vegetation Maps" Geogr. Rev., Vol. 46 (1956), pp. 155-167.

Larsen, A.J., "Roads and the Settlement of Minnesota", Minnesota History, Vol. 21 (1940), pp. 225-244.

Leppard, H.M., "The Settlement of the Peace River Country", Geogr. Rev., Vol. 25 (1935), pp. 62-78.

Lower, A.R.M., Colony to Nation, Longman's, Green & Co., Toronto, 1951, 600 pp.

McDermott, G.L., "Frontiers of Settlement in the Great Clay Belt, Ontario and Quebec", AAAG, Vol. 51 (1961), pp. 261-273.

MacGregor, J.G., The Land of Twelve-Foot Davis, Applied Art Products, Edmonton, 1952, 395 pp.

Mackintosh, W.A., Prairie Settlement: The Geographical Setting, Vol. I of The Canadian Frontiers of Settlement Series, W.A. Mackintosh and W.L.G. Joerg (eds.), The Macmillan Co. of Canada Ltd., Toronto, 1934, 242 pp.

Macoun, James M., Report on the Peace River Region, Geol. Surv. of Can., Bulletin No. 855, 1904.

Macoun, John, "Report to Accompany Selwyn's Report on Exploration in British Columbia in 1875" in Report of Progress for 1875-76, Can. Geol. Survey, Dawson Bros., Montreal, 1877, pp. 83-86, 149-164.

________, Manitoba and the Great North-West, World Publ. Co., Guelph, 1882, 687 pp.

Malin, J.C., "'Grassland', 'Treeless', and 'Subhumid' A Discussion of Some Problems in the Terminology of Geography", Geogr. Rev., 1947, pp. 241-250.

________, "Soil, Animal and Plant Relations of the Grasslands Historically Reconsidered", The Scientific Monthly, April, 1953, pp. 202-220.

Meinig, D.W., "The Growth of Agricultural Regions in the Far West", Journ. of Geogr., Vol. 54 (1955), pp. 221-232.

Merrens, H.R., "The Physical Environment of Early America: Images and Image Makers in Colonial South Carolina", Geogr. Rev., Vol. 59 (1969), pp. 530-556.

Meyer, A.H., "Circulation and Settlement Patterns of the Calumet Region of Northwest Indiana and Northeast Illinois (The First Occupance - the Pottawatomie and the Fur Trader - 1830)" AAAG, Vol. 44 (1954), pp. 245-274.

________, "Circulation and Settlement Patterns of the Calumet Region of Northwest Indiana and Northeast Illinois (The Second Stage of Occupance - Pioneer Settler and Subsistence Economy, 1830-1850)", AAAG, Vol. 46 (1956), pp. 312-356.

Mills, F.C., Statistical Methods, Holt, Rinehart and Winston, New York, 1955.

Morton, W.L., "The Significance of Site in the Settlement of the American and Canadian Wests", Agricultural History, Vol. 25, No. 3, pp. 97-103.

Moss, E.H. and J.A. Campbell, "The Fescue Grasslands of Alberta" Can. Journ. of Research, Vol. 25, pp. 209-227.

Moss, E.H., "Grasslands of the Peace River Region, Western Canada", Can. Journ. of Botany, Vol. 39 (1952), pp. 98-124.

Nicholson, N.L., "The Establishment of Settlement Patterns in the Ausable Watershed, Ontario", Geogr. Bull., No. 1, 1951, pp. 1-13.

Odynsky, W., A. Wynnyk and J.D. Newton, Reconnaisance Soil Survey of the Grande Prairie and Sturgeon Lake Sheets, Alberta Soil Survey Report No. 18, Research Council of Alberta, Un. of Alberta, Edmonton, 1956, 111 pp.

Odynsky, W. et. al., Reconnaisance Soil Survey of the Beaverlodge and Blueberry Mountain Sheets, Alberta Soil Survey Report No. 20, Research Council of Alberta, Un. of Alberta, Edmonton, 1961, 123 pp.

Ogilvie, W., Report on the Peace River and Tributaries in 1891, Canada, Department of the Interior, Queen's Printer, Ottawa, 1892, 41 pp.

Pelzer, Karl J., Review of Heinz Lehmann's Map of Germans in the Prairie Provinces, Geogr. Rev., Vol. 30 (1940), p. 487.

Pike, W., The Barren Ground of Northern Canada, Macmillan and Co., London, 1892, 300 pp.

Raymond, C.W., and J.A. Rayburn, "Land Abandonment in Prince Edward Island", Geogr. Bull., No. 19, 1963, pp. 78-86.

Ritchie, J.C., "A Vegetation Map From the Southern Spruce Forest of Manitoba", Geogr. Bull., No. 12, 1958, pp. 39-46.

Roe, F.G., "Early Opinions on the Fertile Belt of Western Canada", Can. Hist. Rev., 1946, pp. 131-149.

________, "Early Agriculture in Western Canada in Relation to Climatic Stability", Ag. History, Vol. 26, (1952), pp. 104-123.

Sanderson, M., "Drought in the Canadian Northwest", Geogr. Rev., Vol. 38, (1948), pp. 289-299.

Shantz, H.L., "The Natural Vegetation of the Great Plains Region", AAAG, Vol. 13, (1923), pp. 81-107.

________, "The Place of Grasslands in the Earth's Cover of Vegetation" Ecology, April, 1954, pp. 143-151.

Sitwell, O.F.G., "Land Use and Settlement Patterns in Pictou County, Nova Scotia", Unpublished Ph.D. Dissertation, Un. of Toronto, 1968, 321 pp.

Somerset, H.S., The Land of the Muskeg, William Heinman, London, 1895.

Tracie, C.J., Agricultural Settlement in the South Peace River Area, Unpublished M.A. thesis, Un. of Alberta, 1967, 91 pp.

Van Cleef, E., "The Finns of the Pacific Coast of the United States, and Consideration of the Problem of Scientific Land Settlement", AAAG, Vol. 30 (1940), pp. 25-38.

________, "Finnish Settlement in Canada", Geogr. Rev., Vol. 42 (1952), pp. 253-266.

Vanderhill, B.G., Settlement in the Forest Lands of Manitoba, Saskatchewan and Alberta: A Geographic Analysis, Unpublished Ph.D. Dissertation, Un. of Michegan, 1956.

________, "Trends in the Peace River Country", Can. Geogr., Vol. 7 (1963), pp. 33-41.

Victorov, S.V., Ye.A. Vostokova and D.D. Vyshivkin, Short Guide to Geo-Botanical Surveying, The Macmillan Co., New York, 1964, 158 pp.

Vogl, R.J., "Vegetational History of Crex Meadows, A Prairie Savannah in Northwest Wisconsin", Am. Midland Naturalist, No. 1, July, 1964, pp. 157-175.

Watson, J.W., "The Role of Illusion in North American Geography: A Note on the Geography of North American Settlement", Can. Geogr., Vol. 13 (1969), pp. 10-27.

Watts, F.B., "The Natural Vegetation of the Southern Great Plains of Canada", Geogr. Bull., No. 14, 1960, pp. 25-43.

Wellman, B.B., A History of the Peace River Country of Western Canada, Unpublished M.A. Thesis, Un. of Arizona, 1965.

Willis, G.A., Development of Transportation in the Peace River Region of Alberta and British Columbia - With an Evaluation of Present Day Rail and Road Commodity Flow Patterns, Unpublished M.A. Thesis, Un. of Alberta, 1966, 139 pp.

Wonders, W.C., "The Nature and Resources of the Peace River Area", Planning in Alberta Series, 1955-56, Edmonton, 1956.

Wood, J.D., "The Woodland - Oak Plains Transition Zone in the Settlement of Western Upper Canada", Can. Geogr., Vol. 5, 1961, pp. 43-47.

APPENDIX A

THE CHI-SQUARE TEST

Fundamentally, the chi-square test indicates the statistical significance of an association between two variables. It does so by measuring the departure of observed frequencies (o) from expected frequencies (e) by the formula; chi-square = sum of $\frac{(o-e)^2}{e}$ for the number of categories used. The observed frequencies are those that actually occur as distributed in each of the categories devised for the variable to be analyzed. The expected frequencies are those that would be expected to occur in each category if their distribution into these categories were governed by the conditions set out in the null hypothesis. This is a hypothesis which is incompatible with the hypothesis to be proved and it normally assumes that the distribution of frequencies is governed by chance. The expression of the departure between the expected and observed frequencies is the chi-square value or number.

Tables of the probability distribution of chi-square value have been constructed mathematically and indicate the probability (usually in decimal values) of obtaining a certain chi-square value by chance. If the decimal value is low, the probability of an association between the two variables is high or significant and the null hypothesis (that the association is due to chance) should be rejected. If, however, the decimal value is high, the probability of an association between the variables is low and the null hypothesis must be retained. If a chi-square value occurs at the .01 level, a departure of the observed

frequencies from the expected frequencies of that magnitude would occur by chance only one time in a hundred. Thus it may be said that there is 99 per cent probability of an association between the two variables *i.e.* that a departure of that magnitude is due to the variables and not to chance.

Example

Suppose we have a large open box. The bottom of the box has been divided into three areas as follows: *a* occupies 10 per cent of the bottom; *b* occupies 60 per cent of the bottom and *c* occupies 30 per cent of the bottom. If we were to take one hundred round beads and drop them simultaneously onto the the bottom of the box we would expect under completely chance circumstances that ten beads would come to rest on area *a*, sixty beads on area *b* and thirty beads on area *c*. In other words, we would expect the total number of beads coming to rest on each area would be determined by the proportion of the bottom of the box occupied by each area. This would be the *expected* frequency distribution. If we actually dropped the beads and then counted the number coming to rest on each area we would be calculating the *observed* frequency distribution. If we actually came up with the same distribution that we expected (no difference between observed and expected frequencies) a chi-square test applied to this situation would yield a value of zero. If we dropped the beads often enough we might even find that one time in one thousand we would get a distribution of 50 beads on *a*, 10 beads on *b*, and 40 beads on *c*, even though the operation was performed in exactly the same way every time. A chi-square test applied to this

last distribution would yield a high chi-square value.

By performing the bead dropping operation 100 or 1000 times and applying the chi-square test to each resultant distribution, we would obtain 100 or 1000 chi-square values. If we ranked them according to the frequency with which they occurred we would have constructed a probability distribution of chi-square values. This would enable us to apply the chi-square test to any subsequent bead-dropping operation, read the chi-square value on the table we had constructed and determine the probability of such a value occurring by a chance determination of the distribution of beads. If the chi-square value was indicated to be at the .01 level of probability we could say that the distribution, although possible by chance can be expected only once in a hundred times. Conversely, we could say that there is a 99 per cent probability of some non-chance factor governing the distribution; perhaps half the beads are steel-cored and a magnet has been placed under area _a_. More complex tables of chi-square probabilities are constructed mathematically and give the probability of association for any single operation that compares an observed frequency distribution with an expected frequency distribution.

The chi-square value is therefore an indicator of _probability_ of associaton. In itself it does not reveal anything about the nature of the association nor does it follow that a high probability of association indicates a dependence of one variable on the other. Further details on the chi-square test may be found in : H.M. Blalock, _Social Statistics_, McGraw-Hill Book Co. Inc., New York, 1960, pp. 212-234;

and S. Gregory, Statistical Methods and the Geographer, Longman's, Green & Co., London, 1963, pp. 151-166.

One additional point should be made. The choice of the level at which an association is no longer significant *i.e.* the point at which the null hypothesis must be retained, is made rather arbitrarily. The choice of the.05 level for this study however was governed by the fact that the concensus among those who use this technique is that it is "reasonable". Thus, a probability of .05 or lower is considered significant, and a probability higher than .05 is considered not significant.

APPENDIX B

CLIMATIC SUMMARIES

Mean Daily Temperature - Selected Stations

(in degrees Fahrenheit)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Beaverlodge	7.4	12.1	21.6	37.1	49.9	55.9	60.2	57.7	50.2	39.8	23.7	12.8
Grande Prairie	3.1	8.4	19.5	37.0	50.0	56.3	60.3	58.6	49.9	38.1	23.3	9.5
Peace River	-7.9	5.0	17.2	34.8	49.9	56.4	60.6	57.1	50.3	39.3	17.5	4.8
Edmonton (Int. Airport)	4.5	9.9	20.6	38.3	50.9	56.4	61.6	58.6	50.3	39.7	23.1	12.1
Lacombe	6.8	11.8	21.5	37.9	50.3	56.3	62.4	58.9	50.8	40.5	24.5	13.6

Source: Canada Department of Transport, Meteorological Branch, Climatic Normals (Vol. 1 - Temperature, Toronto, 1958.

Mean Monthly Precipitation - Selected Stations

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av. Annual Precipitation
Beaverlodge	1.26	1.16	1.01	.83	1.60	2.22	2.52	2.04	1.58	1.25	1.29	1.15	17.91
Grande Prairie	1.33	1.20	.82	.71	1.57	2.47	2.38	1.99	1.25	1.14	1.08	1.33	17.27
Peace River	.44	.56	.56	.60	1.15	1.98	2.19	1.58	1.18	.78	.58	.66	12.26
Edmonton (Int. Airport)	1.05	.74	.90	1.06	1.68	3.36	3.21	2.70	1.26	.84	.81	.87	18.48
Lacombe	.75	.79	.96	1.32	2.02	3.48	2.85	2.52	1.48	.90	.64	.64	18.35

Source: Canada, Department of Transport, Meteorological Branch, Climatic Normals (Vol. II - Precipitation) Toronto, 1968.

Frost Summary for Selected Stations

Station	Location	Elevation	Record Total Years	Record Years Between 1931-60	Average Frost-free Season (above 32°F)	Last Spring Frost (Av. 1930-68)	First Fall Frost (Av. 1930-68)	Longest Frost-Free Season (total record)	Shortest Frost-Free Season (total record)
Beaverlodge	55° 11'N 119° 22'W	2500'	48	30	107	May 23	Sept. 8	139	26
Dunvegan	55° 56'N 118° 35'W	1305'	37	10	82	May 15	Aug. 28	110	4
Fairview	56° 4'N 118° 23'W	2160'	29	29	108	May 1	Sept. 9	145	77
Ft. Vermilion	58° 23'N 116' 03'W	915'	51	30	76	May 14	Aug. 22	120	4
Goodfare	55° 16'N 119° 42'W	2700'	14	13	54	May 28	Aug. 14	92	10
Grande Prairie	55° 11'N 118° 53'W	2190'	19	19	108	May 3	Sept. 7	143	80
High Prairie	55° 26'N 116° 30'W	1968'	31	30	84	May 12	Aug. 29	115	53
Rycroft	55° 46'N 118° 36'W	1983'	14	14	78	May 7	Aug. 22	98	27
Slave Lake	55° 17'N 114° 46'W	1920'	38	30	80	May 12	Aug. 28	123	24
Edmonton (Industrial)	53° 34'N 113° 31'W	2219'	23	23	123	May 18	Sept. 19	156	88
Lacombe	52° 28'N 113° 45'W	2783'	53	30	92	June 4	Sept. 4	137	32

Source: Manuscript, Department of Transport, Meteorological Branch, Ottawa.

APPENDIX C

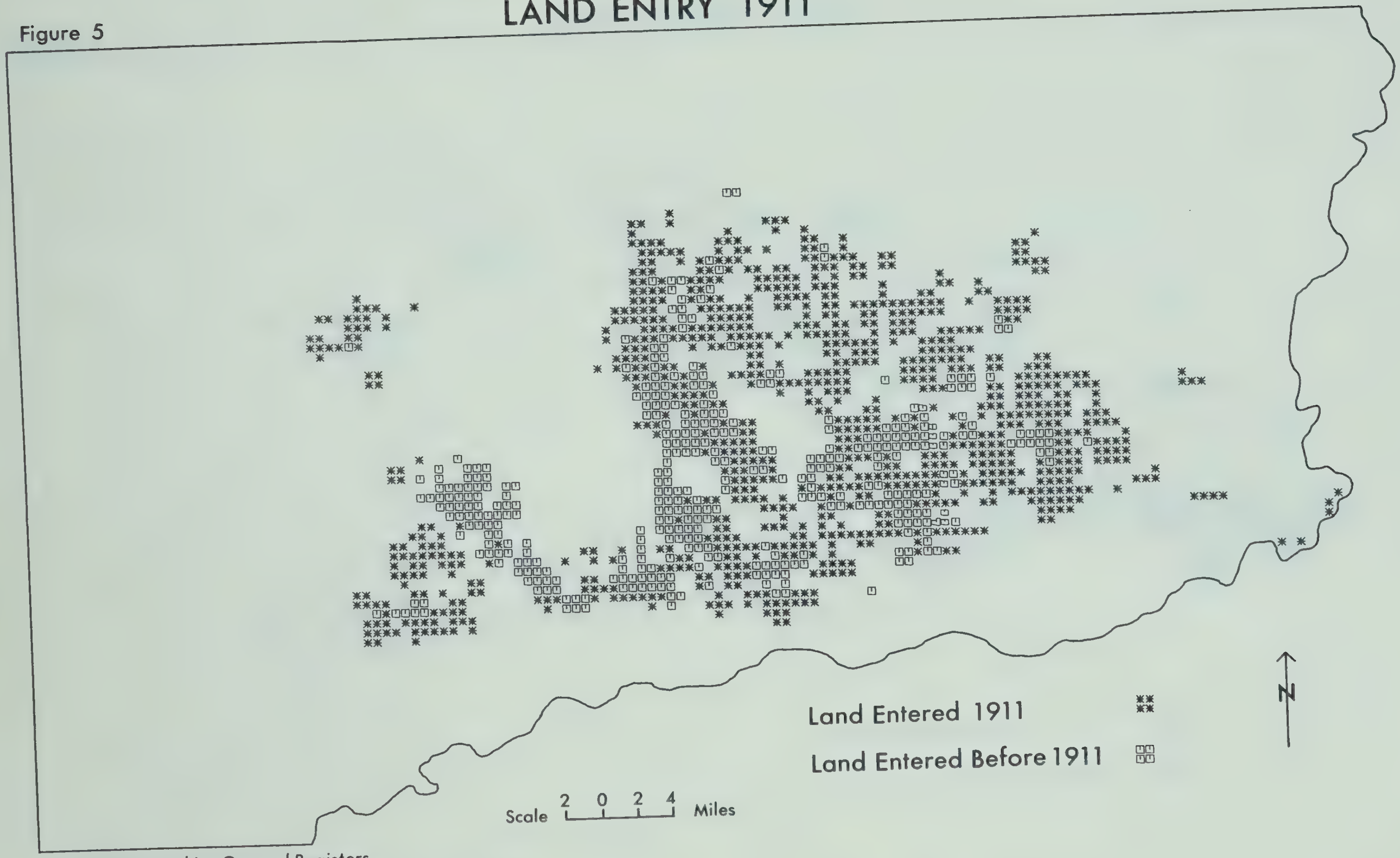
THE PROCESS OF LAND ENTRY AND LAND ALIENATION

Figure 5 Land Entry 1911
Figure 6 Land Entry 1912
Figure 7 Land Entry 1914
Figure 8 Land Entry 1916
Figure 9 Land Entry 1918
Figure 10 Land Entry 1928
Figure 11 Land Entry 1957-68
Figure 12 Land Patented 1916
Figure 13 Land Patented 1928
Figure 14 Land Patented 1938
Figure 15 Land Patented 1968

The time periods above were chosen to illustrate the significant features of the process of agricultural expansion. Four key time periods were chosen for land entry: 1911 - near the beginning of the period and also a peak in the number of entries; 1916 - the year the railway entered the study area; 1928 - a year near the end of significant expansion, the year many quarters of school land were disposed of, and another peak in land entries; 1957-68 - the maximum extent of total agricultural expansion. The years 1912, 1914 and 1918 were chosen to illustrate expansion in the intervening years. The periods chosen for land patented provide the same overview but as the process of patenting lagged behind land entry; 1938 was chosen as an intermediate year.

Figure 5

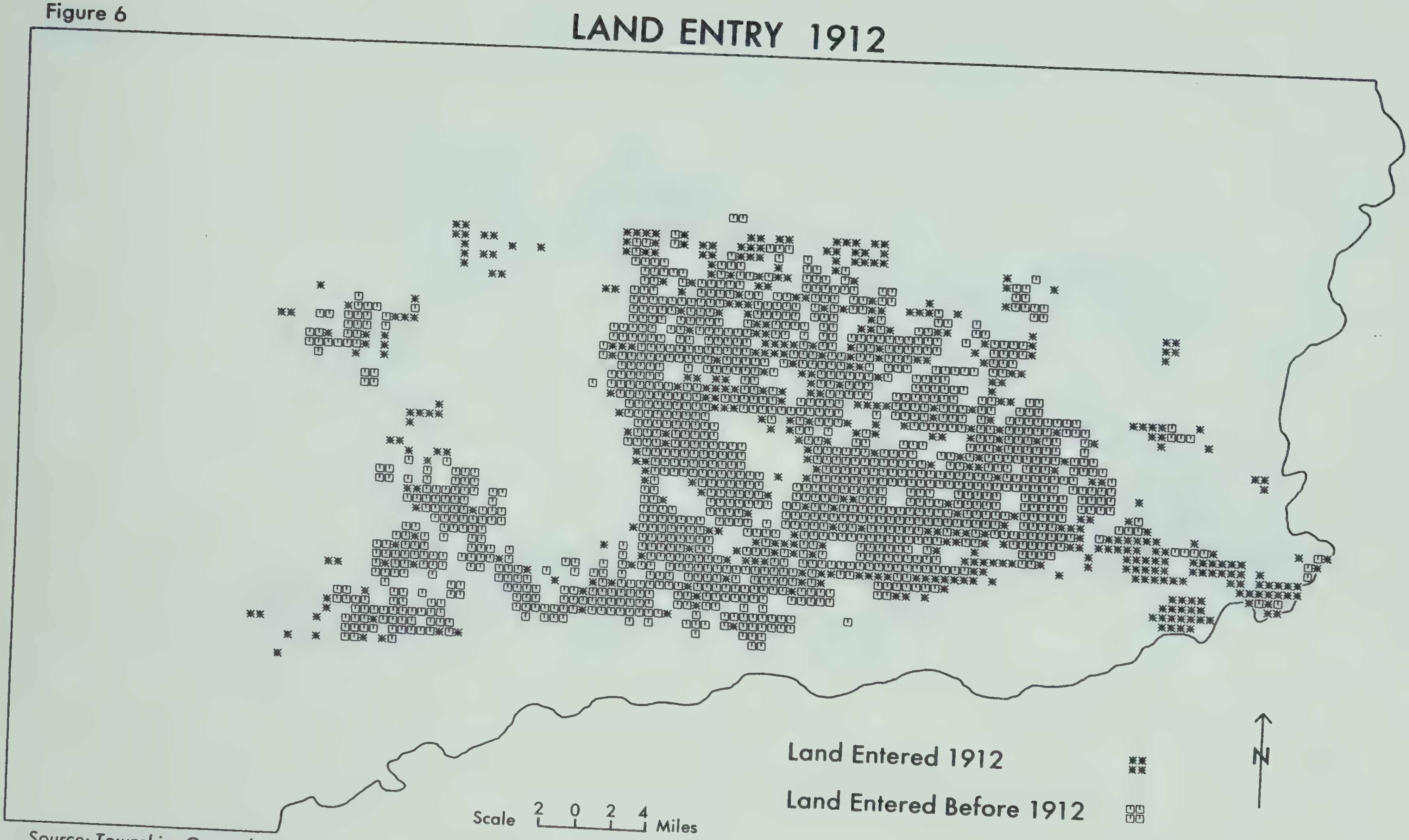
LAND ENTRY 1911



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 6

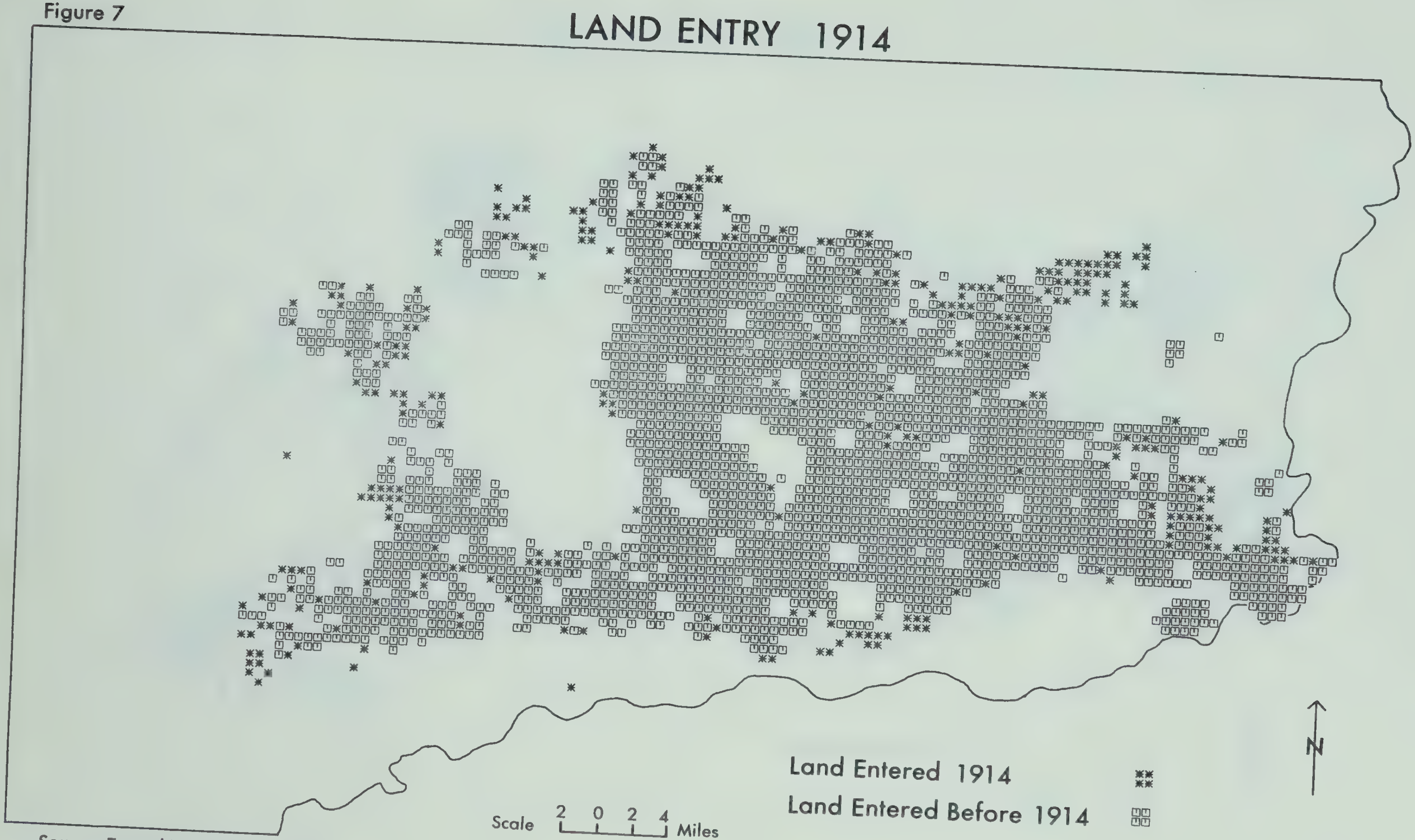
LAND ENTRY 1912



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 7

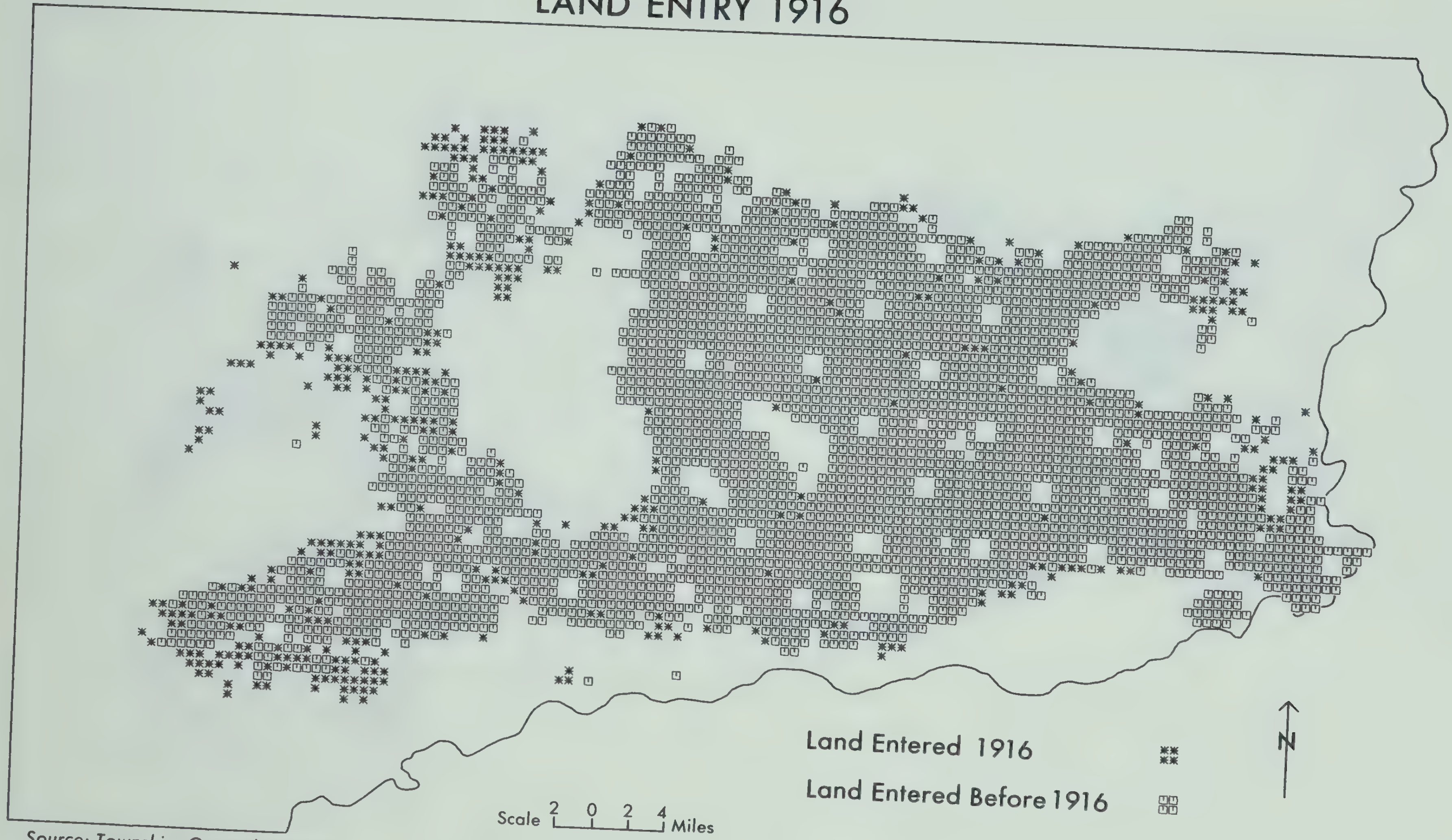
LAND ENTRY 1914



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 8

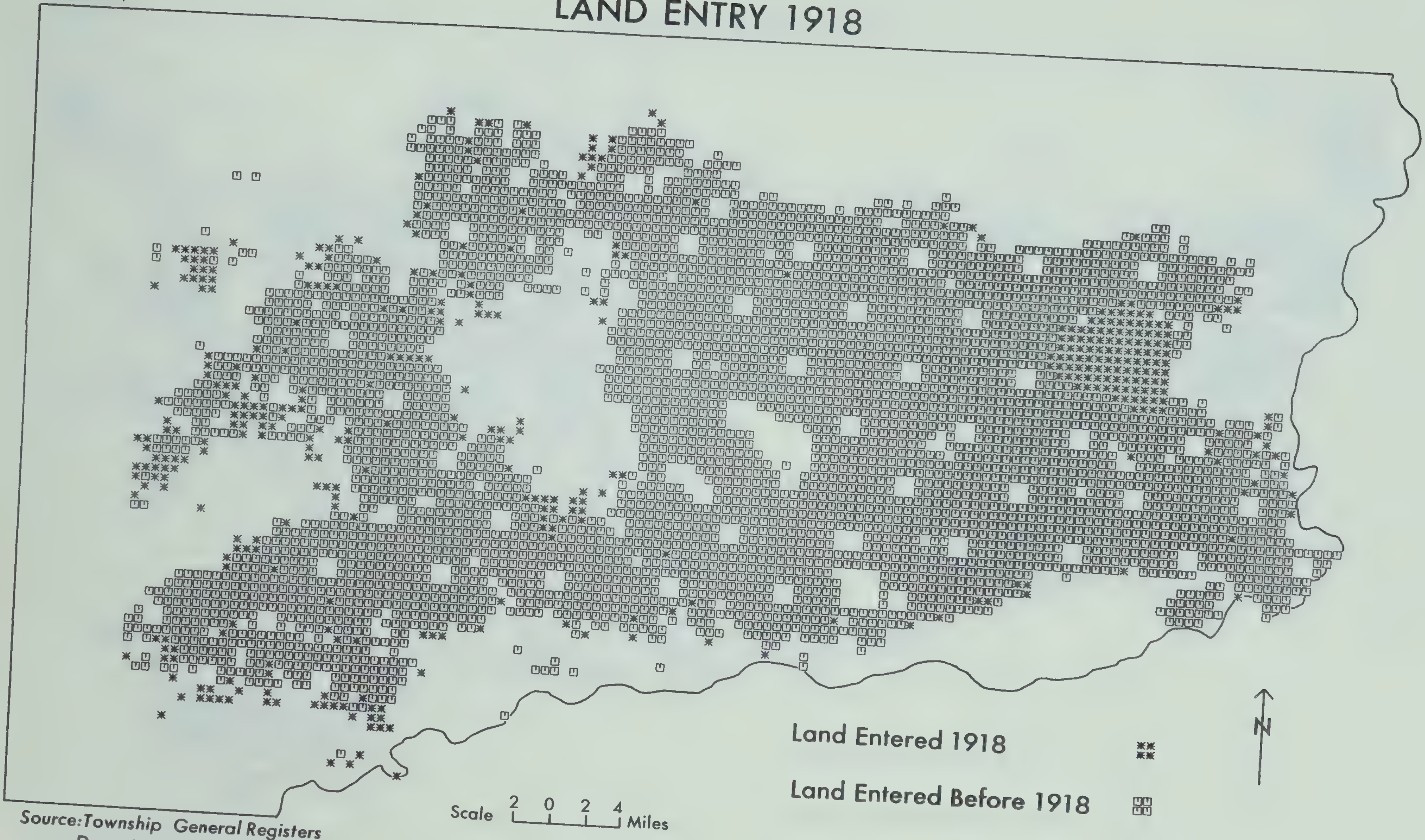
LAND ENTRY 1916



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 9

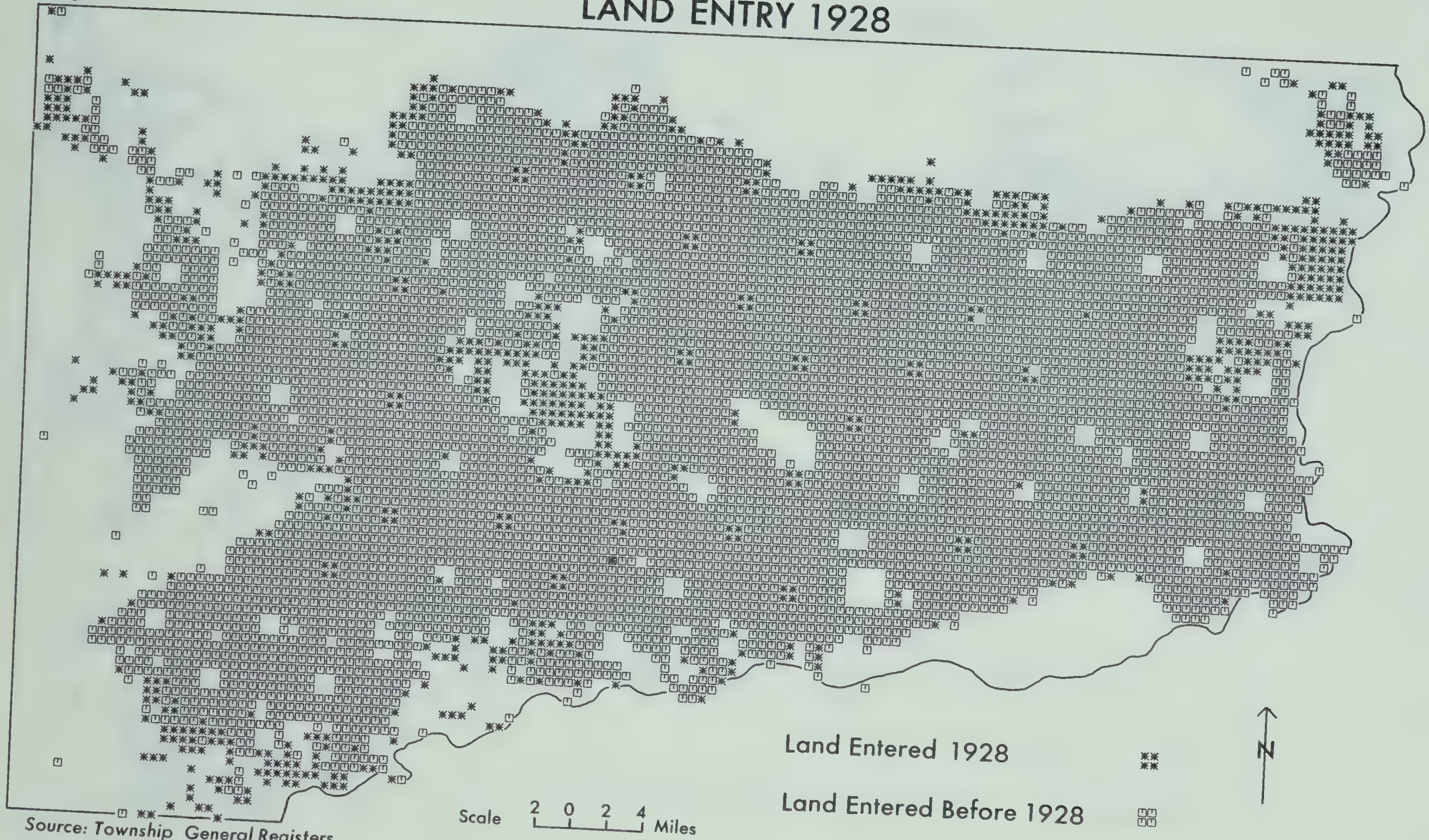
LAND ENTRY 1918



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 10

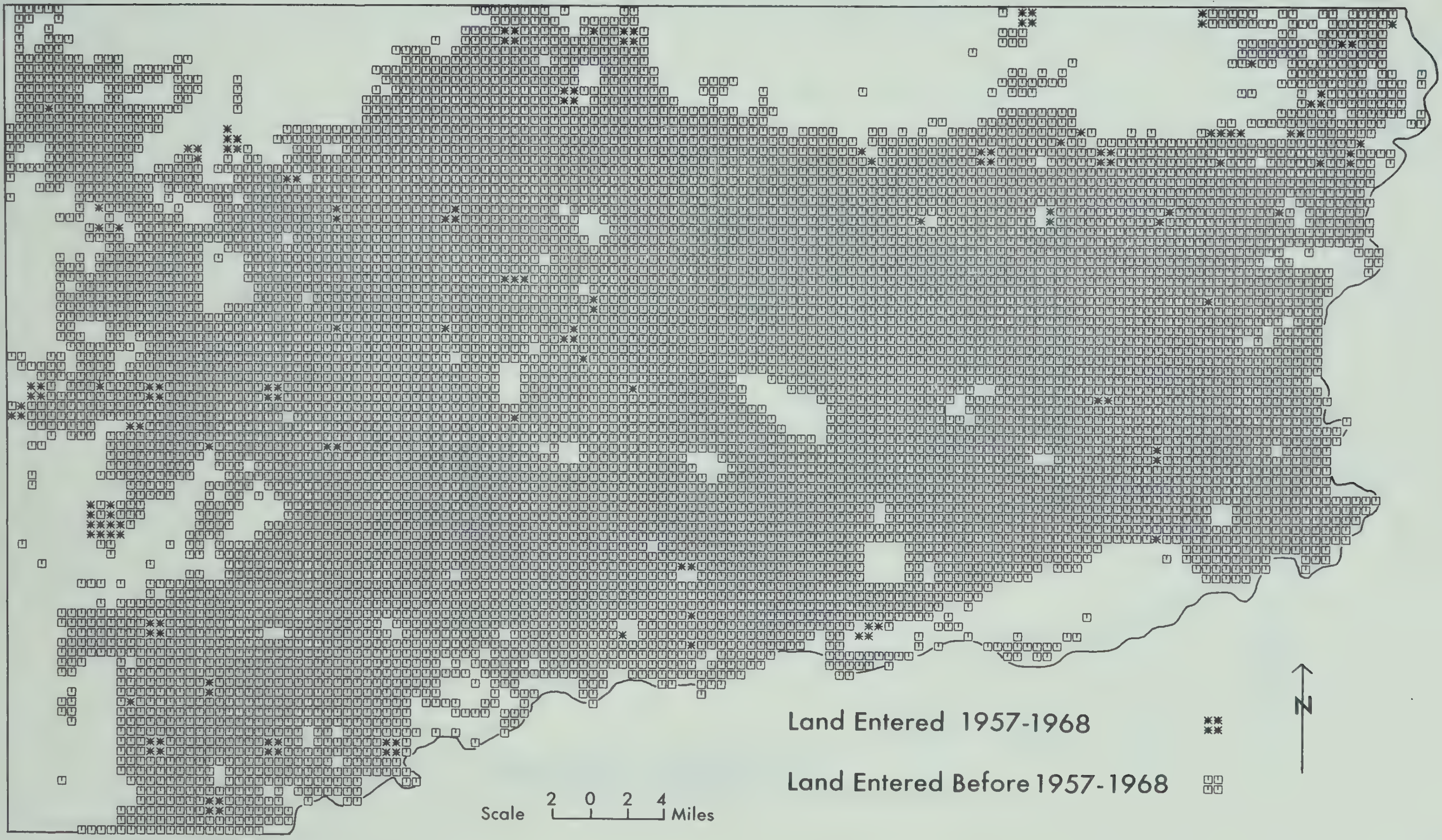
LAND ENTRY 1928



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 11

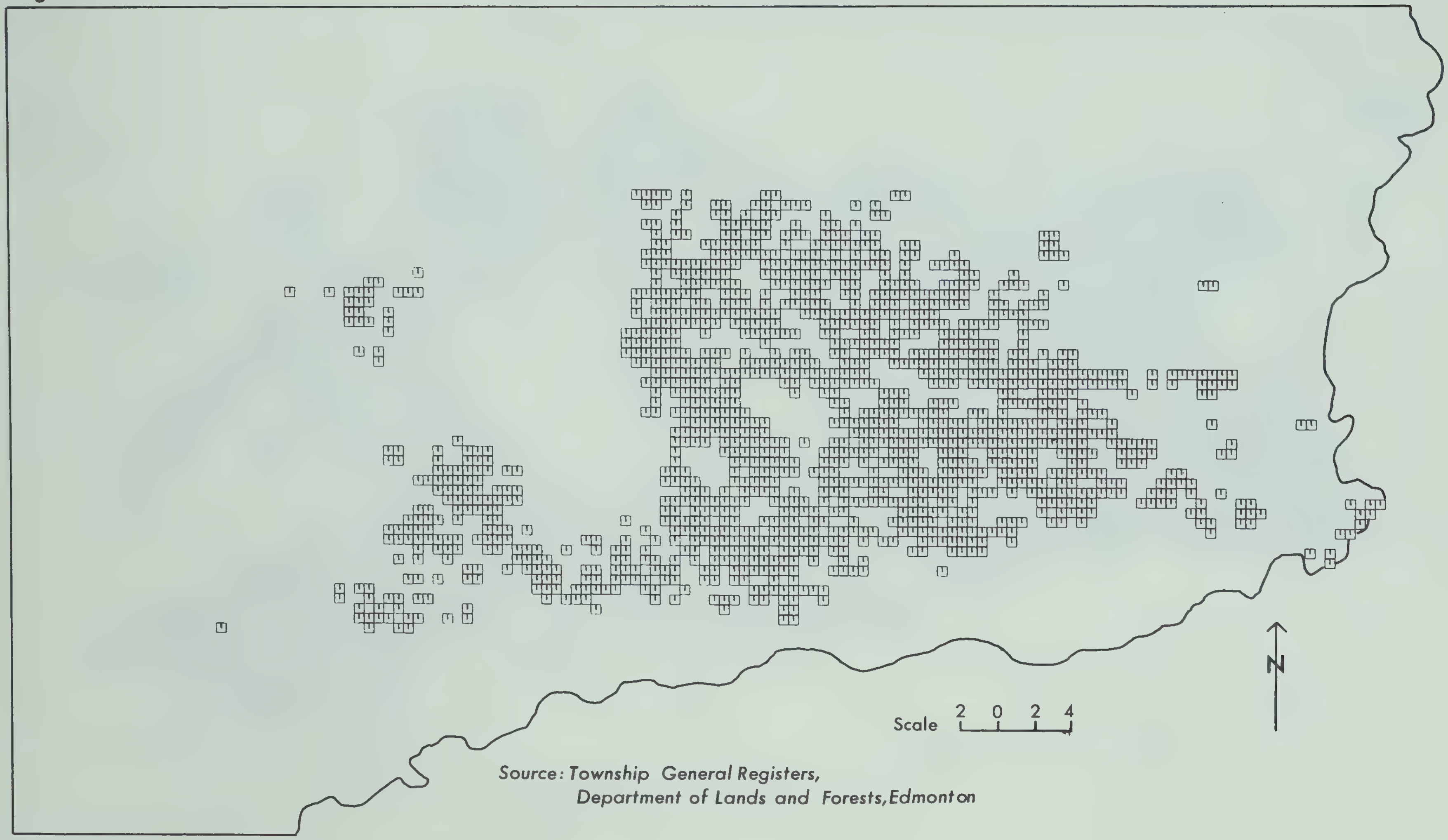
LAND ENTRY 1957-1968



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 12

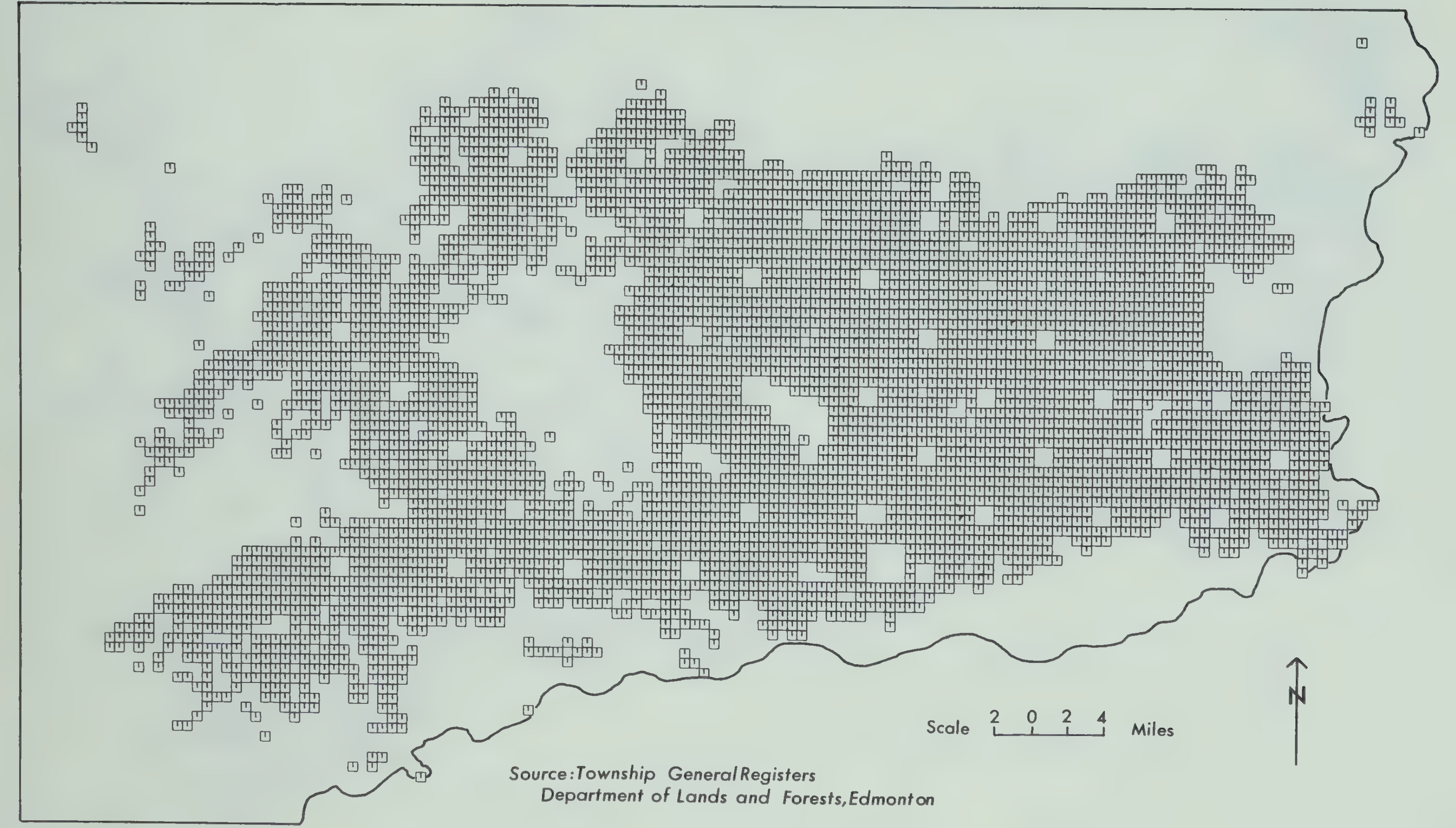
LAND PATENTED 1916



Source: Township General Registers,
Department of Lands and Forests, Edmonton

Figure 13

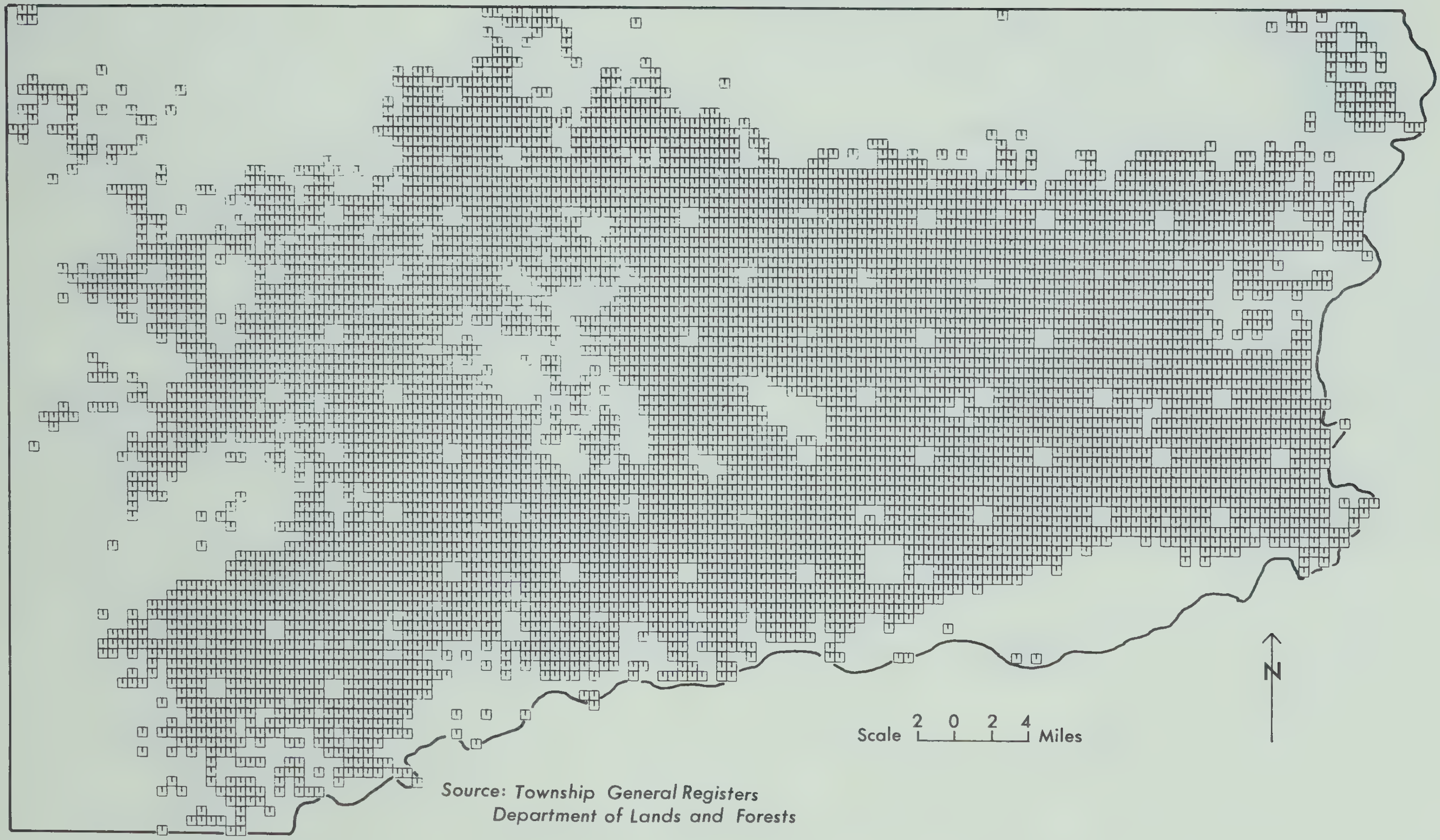
LAND PATENTED 1928



Source: Township General Registers
Department of Lands and Forests, Edmonton

Figure 14

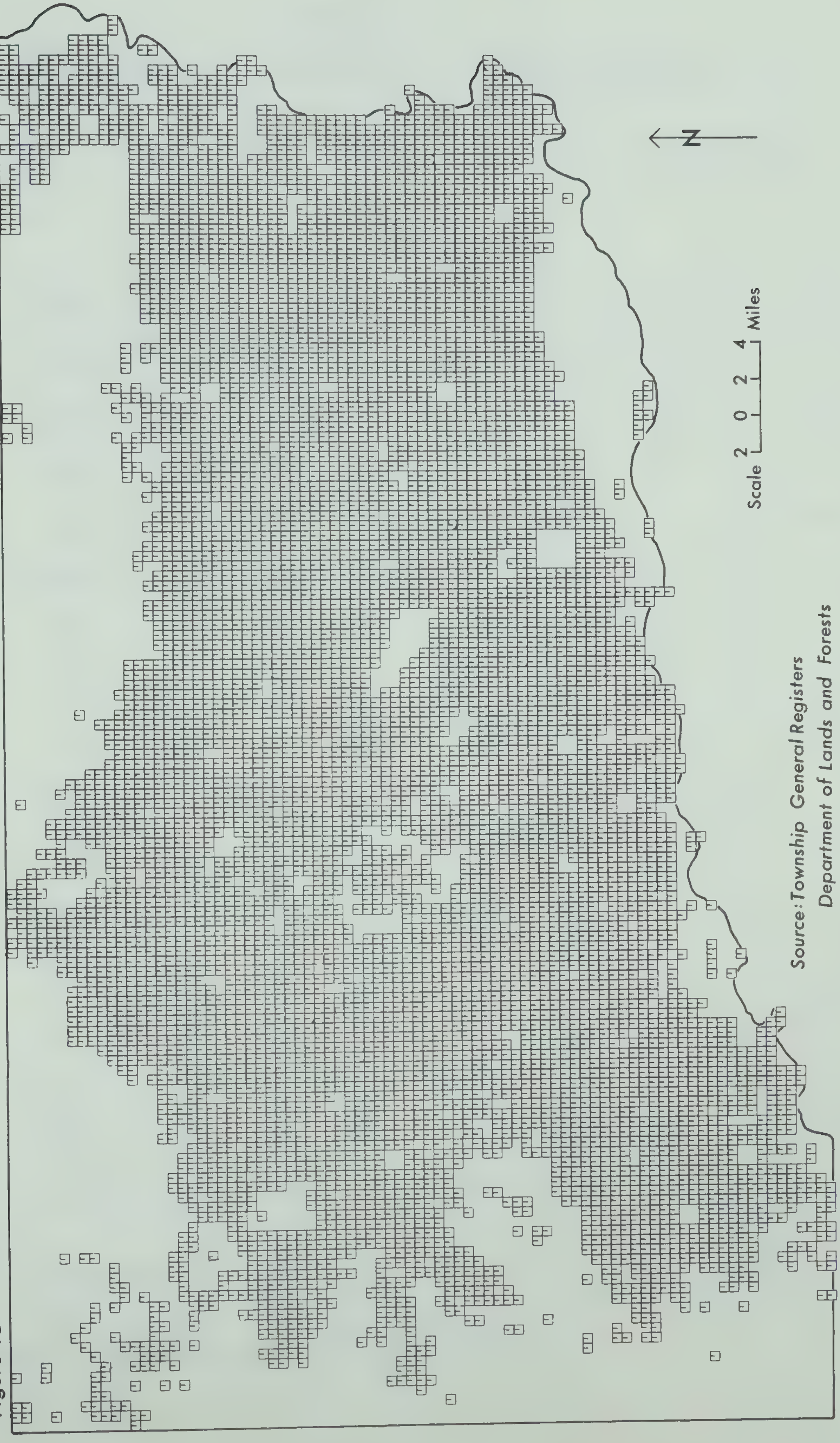
LAND PATENTED 1938



Source: Township General Registers
Department of Lands and Forests

Figure 15

LAND PATENTED 1968



Source: Township General Registers
Department of Lands and Forests

APPENDIX D

CATEGORY VALUES - LAND ENTRY AND COMBINED VARIABLES*

Category Values - Land Entry and Vegetation/Distance to Transportation

Variable	Time Periods								
	1	2	3	4	5	6	7	8	9
R1/V1	+97.2	+920.5	+504.6	+234.4	+241.2	+209.5	+25.0	-1.0	0.0
R1/V2	+1.7	+33.0	+70.6	+110.3	+168.1	+177.8	+32.1	+5.0	+36.0
R1/V3	-18.4	+34.7	-3.8	-3.3	-5.4	-24.3	-5.4	-5.6	-22.5
R1/V4	-1.0	-7.7	+11.6	-4.0	-2.3	-1.4	-2.3	-8.3	+456.3
R2/V1	+213.3	+5.4	+2.8	+115.2	+85.3	+18.0	+24.5	+8.0	ID
R2/V2	+5.8	-9.4	-9.0	-0.4	+17.3	+104.1	+51.2	+20.0	+4.5
R2/V3	-4.7	-94.0	-40.3	-30.4	-10.8	-16.1	-35.4	-10.5	-43.0
R2/V4	-6.0	-9.0	-5.1	-9.0	-8.0	-5.4	-9.0	-7.1	+0.9
R3/V1	+42.9	+44.4	+12.8	+4.0	+16.3	+32.0	+32.0	+4.5	-0.5
R3/V2	-3.4	+1.8	+0.6	+29.5	+16.9	+64.0	+144.0	+44.4	+2.5
R3/V3	-90.4	-64.9	-43.1	-23.0	-3.2	-6.0	+26.6	+30.7	+0.2
R3/V4	-7.0	-13.0	-7.0	-3.6	-7.0	-1.4	0.0	-1.1	0.0
R4/V1	ID	NA	ID	ID	ID	+12.5	+40.5	ID	ID
R4/V2	-2.0	-4.0	-1.8	-2.0	+0.2	+8.1	+9.8	+3.2	+1.0
R4/V3	-39.0	-80.0	-53.0	-42.0	-52.9	-28.4	-26.0	-3.1	+0.3
R4/V4	-6.0	-13.0	-7.0	-5.0	-8.0	-9.0	-11.0	-10.3	-4.1
Chi-Square Value	538.8	1334.8	773.1	616.1	642.9	722.0	474.8	162.0	571.8

*Explanation of categories appears on page 152.

Category Values - Land Entry and Vegetation/Distance to Transportation (Con'd)

Variable	Time Periods							
	10	11	12	13	14	15	17	18
R1/V1	-5.4	-7.1	+96.8	-0.8	-6.0	-0.3	+50.0	+32.0
R1/V2	-0.2	+1.3	+27.6	-0.1	-6.0	0.0	+40.5	+3.0
R1/V3	-1.8	-2.6	+1.3	+18.2	+9.8	+1.7	+5.7	+0.2
R1/V4	-3.2	+5.0	-13.8	-2.4	-0.1	-2.6	-3.8	-4.1
R2/V1	-2.0	+2.0	NA	NA	ID	ID	ID	ID
R2/V2	+24.5	+0.5	ID	ID	ID	ID	ID	ID
R2/V3	+0.7	+1.3	-49.1	-55.4	-18.0	-8.8	-20.2	-4.3
R2/V4	0.0	0.0	-2.0	-0.2	+0.7	0.0	-2.0	0.0
R3/V1	0.0	+4.5	ID	NA	NA	NA	NA	NA
R3/V2	+11.6	+7.2	-1.0	NA	NA	NA	NA	NA
R3/V3	-3.0	-0.1	-15.6	-3.0	-4.0	-1.0	-4.0	-2.0
R3/V4	-0.4	+3.1	ID	ID	ID	ID	ID	NA
R4/V1	ID	ID	NA	NA	NA	NA	NA	NA
R4/V2	+3.2	+64.8	NA	NA	NA	NA	NA	NA
R4/V3	+3.9	-3.1	NA	NA	NA	NA	NA	NA
R4/V4	-0.1	-0.5	NA	NA	NA	NA	NA	NA
Chi-Square Value	60.0	103.1	207.2	80.1	44.6	14.4	126.2	45.6

Category Values - Land Entry and Vegetation/Distance to Settlement

Variables	Time Periods								
	1	2	3	4	5	6	7	8	9
P1/V1	+753.8	+435.9	+256.0	+196.0	+160.0	+71.3	+41.1	+1.3	-1.1
P1/V2	+16.0	+51.6	+31.5	+160.1	+126.8	+123.1	+150.1	+73.1	+40.5
P1/V3	-9.8	-34.6	-2.6	+5.4	+5.2	+0.4	+53.5	+125.2	+7.0
P1/V4	ID	-3.2	+5.0	-4.5	-13.0	-5.9	-2.8	-8.2	+283.7
P2/V1	+28.0	+410.9	+174.2	+53.8	+46.3	+130.7	+40.5	ID	ID
P2/V2	+1.5	+14.8	+13.1	+0.4	+14.1	+169.9	+13.4	+1.8	+2.3
P2/V3	-41.0	-58.9	-37.7	-32.1	-27.6	-38.0	-45.1	-19.0	-10.6
P2/V4	-5.1	-9.3	-3.6	-9.1	-6.4	-5.8	-14.0	-8.6	-1.8
P3/V1	+16.2	+141.3	+56.0	+96.6	+133.3	+40.5	ID	ID	ID
P3/V2	-0.1	-6.7	+0.1	+2.8	+24.5	+16.7	ID	+3.2	0.0
P3/V3	-50.0	-167.6	-63.7	-63.6	-77.4	-75.7	-83.8	-70.2	-53.5
P3/V4	-9.0	-22.0	-2.8	-5.0	-5.1	-7.0	-5.0	-7.0	-2.7
P4/V1	-9.1	ID	NA	NA	NA	NA	NA	ID	ID
P4/V2	-15.0	-9.0	ID	ID	NA	NA	ID	ID	ID
P4/V3	-50.0	-102.1	-14.4	-18.0	ID	ID	ID	-5.0	-4.0
P4/V4	-4.0	-5.0	ID	ID	NA	NA	NA	NA	NA
Chi-square Values	1008.6	1472.9	660.7	647.4	639.7	685.0	449.3	322.6	407.2

Category Values - Land Entry and Vegetation/Distance to Settlement (Con'd)

Variables	Time Periods							
	10	11	12	13	14	15	17	18
P1/V1	-8.3	-2.5	+96.8	-0.8	-6.0	-0.3	+32.0	+18.0
P1/V2	+10.1	+22.5	+20.3	-1.3	-6.0	0.0	+40.5	+8.0
P1/V3	+39.8	+79.5	+104.4	+8.7	+6.7	+7.2	+43.5	+5.2
P1/V4	0.0	+7.0	-6.2	-3.6	0.0	+0.2	-0.5	0.0
P2/V1	ID	ID	NA	NA	NA	NA	ID	ID
P2/V2	+3.3	+12.0	ID	ID	ID	ID	ID	ID
P2/V3	-10.0	-67.0	-60.1	-4.0	-6.1	-13.8	-43.9	-5.6
P2/V4	-4.6	-2.8	-7.2	-0.3	-0.1	+4.0	-7.0	-5.4
P3/V1	ID	ID	ID	NA	NA	NA	NA	NA
P3/V2	+21.3	+8.3	0.0	NA	NA	NA	ID	ID
P3/V3	-23.8	-46.6	-58.1	-7.3	-4.5	-4.0	-9.0	-7.1
P3/V4	-3.0	-1.3	-2.3	ID	ID	ID	ID	ID
P4/V1	ID	NA	NA	NA	NA	NA	NA	NA
P4/V2	ID	NA	NA	NA	NA	NA	NA	NA
P4/V3	-5.0	NA	NA	NA	NA	NA	NA	NA
P4/V4	NA	NA	NA	NA	NA	NA	NA	NA
Chi-square Values	129.2	249.5	355.4	26.0	29.4	29.5	176.4	49.3

Category Values - Land Entry and Distance to Transportation/Distance to Settlement

Variables	Time Periods								
	1	2	3	4	5	6	7	8	9
P1/R1	+189.6	+191.9	+212.4	+188.1	+96.1	+41.4	+18.3	+3.0	+112.0
P1/R2	+147.3	-33.4	-11.8	0.0	+0.8	-0.4	-18.7	+2.6	-0.7
P1/R3	-0.2	+2.4	+0.3	+11.6	+17.3	+6.2	+212.6	+256.1	+49.2
P1/R4	NA	NA	NA	ID	-4.5	+1.0	-1.8	+0.5	-4.0
P2/R1	+4.3	+330.9	+53.2	+5.4	+36.3	+6.5	-9.5	-15.2	-13.4
P2/R2	+2.1	-25.9	-21.0	-12.4	-9.8	+1.0	-7.7	-8.4	-13.1
P2/R3	-27.5	-27.3	-6.9	-17.9	-16.7	0.0	-5.8	-10.0	-3.7
P2/R4	NA	NA	NA	-7.1	-15.1	-3.5	-1.7	+0.8	+9.8
P3/R1	-16.9	+3.9	+3.6	-2.0	-14.7	-18.6	-25.0	-24.0	-22.0
P3/R2	+35.6	-21.3	-12.0	-1.6	+1.5	-4.0	-14.2	-11.1	-24.0
P3/R3	-2.2	-26.7	-24.0	-3.0	-1.4	-2.7	-16.0	-21.0	-20.0
P3/R4	-32.0	-77.0	-41.5	-29.0	-40.0	-25.1	-23.6	-13.0	-2.9
P4/R1	-13.0	-71.1	+5.3	NA	NA	NA	NA	NA	NA
P4/R2	-7.0	-18.0	NA	NA	NA	NA	NA	NA	NA
P4/R3	-41.0	NA	-12.0	-9.0	ID	NA	ID	-5.0	-4.0
P4/R4	-15.0	-27.0	-16.0	-11.0	ID	ID	ID	ID	ID
Chi-square Values	533.7	856.8	420.0	298.1	254.2	110.4	354.9	370.7	278.8

Category Values - Land Entry and Distance to Transportation/Distance to Settlement (Con'd)

Variables	Time Periods							
	10	11	12	13	14	15	17	18
P1/R1	+1.9	+8.7	+136.8	+7.3	+5.7	+8.0	+70.1	+10.0
P1/R2	+5.1	+28.2	-2.0	-11.8	-6.0	-0.6	-3.6	ID
P1/R3	+10.8	+21.8	ID	ID	ID	ID	NA	NA
P1/R4	+21.8	+27.9	NA	NA	NA	NA	NA	NA
P2/R1	-3.0	-16.0	-24.9	+4.2	-0.2	-4.0	-30.7	-8.3
P2/R2	-0.8	-4.8	-33.2	-38.7	-7.2	-6.0	-17.6	+0.1
P2/R3	-3.7	-7.6	-12.3	-3.0	ID	ID	ID	ID
P2/R4	-6.4	-32.0	NA	NA	NA	NA	NA	NA
P3/R1	-29.1	-20.0	-35.6	ID	ID	ID	ID	-3.0
P3/R2	+2.1	-6.1	-23.0	-2.0	-0.4	-3.0	-4.0	-4.2
P3/R3	-6.5	-0.1	-1.7	-3.0	ID	ID	-3.0	ID
P3/R4	-5.0	-9.4	NA	NA	NA	NA	NA	NA
P4/R1	NA	NA	NA	NA	NA	NA	NA	NA
P4/R2	NA	NA	NA	NA	NA	NA	NA	NA
P4/R3	-5.0	NA	NA	NA	NA	NA	NA	NA
P4/R4	NA	NA	NA	NA	NA	NA	NA	NA
Chi-square Values	101.2	182.6	269.5	70.0	19.5	21.6	129.0	25.6

Explanatory Notes for Appendix D

Variables: V - vegetation
R - distance to transportation
P - distance to settlement (post office)

For vegetation:
1) grassland and groveland
2) transitional groveland and park land
3) scrub land and forest land
4) poorly-drained land (open and treed)

For distances:
1) 0-6 miles
2) 7-10 miles
3) 11-20 miles
4) over 20 miles

ID - insufficient data for chi-square calculation
NA - no land available in this category

Note: Positive and negative signs are used only to indicate whether more land (+) or less land (-) than expected was being chosen.

APPENDIX E

INFORMATION RECORDED ON IBM PUNCH CARDS

Main Deck

Column	Information	Code
1 - 4	card number	1 - 9970 with 24 deletions
6 - 8	location (x co-ordinate)	000 - 143
9, 10	location (y co-ordinate)	00 - 83
12	vegetation	0 - brule (burned)
13	vegetation	0 - deciduous 1 - mixed wood 2 - coniferous
14	vegetation	1 - grassland 2 - groveland 3 - transitional groveland 4 - parkland 5 - scrub land 6 - forest land 7 - poorly-drained (open) 8 - poorly-drained (treed)
15 - 16	year of first entry	08 - 68 (1908-1968)
18	type of first entry	1 - homestead 2 - South African Scrip 3 - Soldier Grant 4 - sale, homestead sale, agricultural farm sale 5 - second homestead 6 - Civilian Agricultural Lease or Veteran Homestead Lease 7 - Veteran Agricultural Lease or Veteran Homestead Lease
20	number of cancellations	0 - 8
22 - 23	number of years from first entry to final disposition	
24	success of final entry	1 - successful (patented) 2 - unsuccessful (cancelled)
26 - 27	year of last entry	08 - 68 (1908-1968)
29 - 30	year of last cancellation	08 - 68 (1908-1968)
32 - 33	number of years land vacant between first entry and final disposition	
35 - 36	year of patent	08 - 68 (1908-1968)

Column	Information	Code
38 - 39	year of entry restriction	08 - 68 (1908-1968)
41	agricultural capability rating	3 - 7 (based on Research Council of Alberta classification with 3 being 'pasture and woodland')
47	type of last entry	as column 18
70 - 71	year of survey	08 - 68 (1908-1968)

Note: Nines in all the columns of a specific information group indicate either "no information" or "not applicable".

Road Deck

1 - 3	card number	001 - 724
5 - 7	location (y co-ordinate)	00.0 - 84.0
8 - 11	location (x co-ordinate)	000.0 - 143.0

Note: Co-ordinates specified where route crossed section lines.

Post Office Deck

1 - 2	card number	1 - 49
3 - 6	location (x co-ordinate)	000.0 - 143.0
7 - 9	location (y co-ordinate)	00.0 - 84.0
11 - 14	year opened	
16 - 19	year closed*	
23	post office name	

*1968 in these columns means post office is currently in operation (December, 1968).

APPENDIX F

TRANSPORTATION ROUTES: MAP SOURCES

Alberta, Department of Agriculture, Edmonton, *Homestead Lands, Alberta*, 1910.

Alberta, Department of Public Works, Edmonton, *Northern Alberta*, 1915.

______________, *Road Map of Alberta*, 1934.

Alberta Motor Association, Edmonton, *Highway Map of Alberta*, various editions, 1924, 1932, 1939, 1942, 1946.

Department of the Interior, Ottawa, *Northern Alberta - Showing Disposition of Lands*, various editions, 1908, 1910, 1911, 1914, 1922, 1926.

______________, *Grande Prairie Land District*, 1912, 1914.

______________, *Map of Peace River and Grande Prairie District Alberta*, 1930.

Department of Mines and Technical Surveys, Ottawa, *Grande Prairie (83M)*, 1:250,000, Ed. 1, 1953; Ed. 2, 1964.

Stovel's Pocket Map of Alberta, Edmonton, 1922 (J.N. Wallace Collection, Un. of Alberta).

B29948